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Event and Comment

Protection for Primary Producers.

THE Commonwealth Government proposes to take a referendum on 6th March on the subject of an addition to section 92 of the Commonwealth Constitution. Two questions naturally arise:—

(1) Why did the fathers of Federation draft section 92—the cause of the farmer's present difficulty—and adopt it in its present form? (2) Why, after thirty-six years of Federation, has it now become evident that this section of the Constitution has, to say the least of it, outlived its usefulness?

So far as can be understood, portion of section 92 was adopted as a compromise when all men's minds were concentrated on tariff policies. The section was deliberately inserted to prevent the different States of the Federation from adopting tariff policies which, while advantageous to them, would have been disadvantageous to other States within the Federation.

Discussing this matter recently, the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, said—

"In those far-off days there was no suggestion of the organisation of primary producers. In fact, the farmer had so long been the victim of economic forces that nobody even suspected that the time would come when the producer would put concrete proposals for his economic security before Parliaments and cause them to be carried into effect.

"It might reasonably be argued that the arbitration tribunals provided by the States and Commonwealth for wage-earners should have their counterparts for the agriculturist. As arbitration conditions obviously could not apply to the farmer, it became necessary to introduce legislation which gave the farmer some control over the disposal of his produce.

"The real intention behind this legislation was to enable the farmer to gain a fairer economic price for his commodities, and the national viewpoint was that the expansion of Australia must be largely agricultural, and that our expansion could take place only when based on a recognition of the claims of the producer for social and economic justice.

"Queensland was the first State of the Commonwealth to recognise these domestic and national equations, and as a result many years ago several pool boards under grower control were established, and it is safe to say that to-day the farmer does not desire, nor can he afford to go back to the old principles of exploitation, to which he was a victim in the years that are gone. The pool boards in Queensland succeeded in establishing a fair economic price for the producer. In fact, they translated into concrete terms that biblical axiom—'The labourer is worthy of his hire.' "

A successful movement of this description naturally attracted attention to Queensland, and after representations the Commonwealth Government entered into the field of organisation. The Federal Government relied on its powers under section 92, which it was believed at that time bound the States but did not bind the Commonwealth. By a series of legislative enactments several main branches of agriculture were able to organise on a Commonwealth plane, and by a combination of authority the State and Federal Governments were able to regulate interstate trade and set up domestic parities.

The position then was, or appeared to be, that the State had full control of domestic trade; the Commonwealth had the power to regulate interstate trade and to fully control export trade.

Then came the James judgment, in which the Privy Council said: "The State has full power to control domestic trade; the Commonwealth has full power to control export trade, but neither the State nor the Commonwealth has any power to regulate or to control interstate trade." As legislation cannot override the Constitution, the position then became grave in so far as Commonwealth-wide organisations functioning under legislation were declared by virtue of the James judgment to be operating on authority possessing no legal sanction.

The Coming Referendum on Commonwealth Marketing.

REFERRING to the referendum to be taken throughout Australia in March next, Mr. Bulcock stated that the people would be simply asked to give back to the Commonwealth the powers the High Court of Australia believed the Commonwealth was possessed of and which it operated for a number of years. He added:—

> "There are many reasons why this submission should be approved, and perhaps the greatest is that all permanence in society is based on justice. As the farmer is compelled to purchase his commodities in a protected market, and as he has made very large contributions to the solvency of Australia, more particularly during the difficult period of depression, it is obviously fair that he should have extended to him, in whatever form may be practicable, the protection that the people of Australia have given to manufacturers, wage earners, and others.
>
> "As the Constitution has proved itself incapable of adjusting itself to the changing conditions of national life and to the new conceptions of agricultural and commercial practices, a readjustment is imperative, for the farmer cannot survive on overseas parity, which he cannot control, and which frequently reacts against him."

For instance, recently there was a rapid decline in the overseas price of butter. This lessened earning power on the British market was in no way related to the cost of production in Australia. In fact, the production costs of butter were greater during the decline than ordinarily, owing to drought conditions. It represents a phase of marketing over which the producer has no control, and which is frequently harsh in its incidence.

These things were recognised nearly three years ago by Governments, when the Butter Stabilisation Scheme came into operation, and even before that the principle of domestic parity was recognised in respect to the Paterson Scheme, which stabilised butter prices to a degree, and also the Dried Fruits Acts, which was some years ago the subject-matter of an appeal to the Privy Council.

To argue that the farmer must rely on overseas parity, which ordinarily determines domestic price, is to assert that the standard of living of the farmer shall be the standard of living in the countries that determine the price in, say, London, or, in other words, that there will be a lowering of the Australian standard of living which shall be applied to one of the classes—the farming class. This, of course, would be obviously unfair, more particularly in view of the fact that, had it not been for the export of primary products during the last ten years, Australia would have been hopelessly insolvent, and would have gone through the grave financial crises that were so sadly in evidence in many countries of the world.

The Minister's New Year Message

WITH the dawn of the New Year, the farming communities are facing a poll of far-reaching importance to primary production throughout the Commonwealth. If the referendum is carried, producers may look forward to further advances in their economic position. As this question is likely to be the most important to be raised this year, and as important consequences for good or evil will follow the decision, I urge the farming community to close their ranks and make every effort to secure the much to be desired "yes" vote.

The year which has just closed has been one of tribulation and hardship for many sections of producers. Drought and disease have sown grim havoc over many of our landscapes, but the courage of our farmers remains undaunted, and all eyes are turned towards the dawn of happier days. I earnestly pray that these hopes will be realised and life on the land made more profitable from every point of view.

We cannot remain unmindful of the lessons of the past year, but must face the problems to which they may be applied in a spirit of resolute endeavour to overcome the difficulties with which our agriculture is faced, in common with that of every other country.

The coming year should see the introduction of a Federal system of marketing control and, in the State sphere, the launching of a too long-delayed scheme for water and fodder conservation.

At this time we remember the women of the bush and their loyalty to their men and their homes and their fortitude in the face of adversity, and especially hope that to them the New Year will bring its due rewards.

On behalf of the Officers of the Department of Agriculture and Stock, and on my own behalf, I sincerely wish our friends on the land in every part of Queensland a happy, contented, and prosperous New Year.

Frank. W. Bulcock

Seed Treatment of Maize.

R. B. MORWOOD, M.Sc., Pathologist, Department of Agriculture and Stock, and W. W. BRYAN, M.Sc.Agr., Instructor in Plant Breeding, Queensland Agricultural High School and College.

A SERIES of experiments designed to test the effect of a mercurial seed dressing on the yield of maize has been carried out at the Queensland Agricultural High School and College, the Departments of Public Instruction and of Agriculture and Stock co-operating. The series was the outcome of a previous experiment ("Queensland Agricultural Journal," XXXVIII. p. 22) in which the possibility of an increase was indicated. In the early experiment seed slightly affected with dry rot (*Diplodia zeæ*) had been used, but it was suspected at the time that the effect of the treatment was due to stimulation rather than to actual control of disease. Further consideration of the problem in the light of the results now obtained with disease free seed would indicate that any increase was due to some disease control factor such as a lessening of the incidence of root rot associated with lightly affected seed.

In the experiments which form the subject of this report carefully selected clean seed was used throughout. A late variety—Fitzroy or Improved Yellow Dent—and a mid-season variety—Golden Superb—were included in the trials as were three different dusts tillantin R., ceresan, and semesan. Other dusts which have been favourably reported upon in America are not available locally.

An apparent definite increase in the yield following treatment with tillantin R. in the first year of the trials could not be substantiated in the subsequent more elaborate experiments. In the following season the crop failed and no results were obtained. In the 1934-35 and 1935-36 seasons extensive and carefully planned trials failed to show any advantage for ceresan and tillantin R. dust treatment of healthy seed. Slight increases in favour of treated seed in the former season were not maintained in the latter when with one variety of maize the untreated plots yielded significantly higher than the treated. In 1934-35 the plots planted with seed treated with the dust semesan had a higher average yield than the untreated and the result was just significant. The results with semesan were, however, little if at all better than those with ceresan, and in view of the generally conflicting results in different seasons little notice can be taken of such an isolated increase.

Results.

Yields for 1932-33 and 1934-35 are at 14 per cent. moisture content. In 1935-36 air-dried weights were taken. Row spacing throughout was 4 feet 6 inches.

Season 1931-32.—Trial lost through drought.

Season 1932-33.—

Plan: Four Beaven half-drill strips.

Plot size: Ten rows, 1 chain long, reduced at harvest to 8 rows, 18 yards long. Sown in hills 3 feet apart, 5 seeds sown, each hill thinned to 3 plants.

Planting date: 23rd November, 1932.

Rainfall: 1,742 points over growing period.

Variety: Fitzroy (late).

Treatment.	Bushels per Acre.	Significantly Exceeds.
1. Tillantin R.	56·75	2
2. Untreated	47·95	..

(Odds are > 200·1 in favour of a difference.
S.E. (single plot) = 1·98 b.p.a. Significant difference = 2·80 b.p.a.)

Season 1933-34.—Trial lost through drought.

Season 1934-35.—

Plan: Four 4 x 4 latin squares. (Two independently randomised squares for each variety.)

Plot size: Six rows, 1 chain long, reduced at harvest to 4 rows, 18 yards long. Sown in hills, as in 1932-33.

Planting date: 26th November, 1934.

Rainfall: 1,731 points over growing period.

Varieties: Improved Yellow Dent (late), Golden Superb (midseason).

Treatment. (Golden Superb.)	Bushels per Acre.	Significantly Exceeds.
1. Semesan	35·53	..
2. Ceresan	34·72	..
3. Tillantin R.	34·02	..
4. Untreated	31·65	..

(Fisher's "Z" test showed that the differences were not significant.)

Treatment. (Improved Yellow Dent.)	Bushels. per Acre.	Significantly Exceeds.
1. Ceresan	31·01	..
2. Semesan	30·66	..
3. Untreated	30·52	..
4. Tillantin R.	29·56	..

(Fisher's "Z" test showed that the differences were not significant.)

Treatment. (Both Varieties.)	Bushels per Acre.	Significantly Exceeds.
1. Semesan	33·09	Untreated
2. Ceresan	32·86	..
3. Tillantin R.	31·79	..
4. Untreated	31·08	..

(S.E. (single plot) = 2·4 b.p.a.
Significant difference = 1·82 b.p.a.)

NOTE.—In this trial (1934-35) mature plant counts were made just prior to harvest. No significant differences in stand could be demonstrated and analyses of covariance for stand and yield showed that in neither variety was there any justification for adjusting yields on the basis of observed differences in stand.

Season 1935-36.—

Plan: Forty-two randomised blocks. (Twenty-one for each variety.)

Plot size: A single row, 86 feet long ($\frac{1}{10}$ acre approximately). Single seeds were spaced one foot apart in the row.

Planting date: 6th December, 1935.

Rainfall: 1,468 points over growing period.

Varieties: Improved Yellow Dent (late), Golden Superb (mid-season).

Row weights were adjusted for stand differences on the basis of a correlation of approximately 0.7 between stand and yield.

Treatment. (Golden Superb.)	Bushels per Acre.	Significantly Exceeds.
1. Untreated	31·26	2 and 3
2. Ceresan	28·23	3
3. Tillantin R.	25·87	..

(S.E. (single plot) = 3·26 b.p.a.
Significant difference = 2·18 b.p.a.)

Treatment. (Improved Yellow Dent.)	Bushels per Acre.	Significantly Exceeds.
1. Ceresan	25·22	..
2. Tillantin R.	24·10	..
3. Untreated	23·51	..

(Fisher's "Z" test showed that no differences were significant.)

Treatment. (Both Varieties.)	Bushels per Acre	Significantly Exceeds.
1. Untreated	27·29	..
2. Ceresan	26·69	..
3. Tillantin R.	24·96	..

(Fisher's "Z" test showed that no differences were significant.)

Conclusion.

The experiments warrant no recommendation for the treatment of well selected maize seed for sowing in Southern Queensland.

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Studies on the Biology and Control of the Large Roundworm of Fowls, Ascaridia galli (Schrank 1788) Freeborn 1923.

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[*Continued from p. 746, Part VI., Vol. XLVI.—December,* 1936.]

PART VII.

II. PROPHYLAXIS.

The control of any parasitic disease cannot be brought to a very high standard of efficiency, unless measures are enforced which will prevent infestation by the parasites concerned, or will at least maintain their numbers below the numerical point at which the parasites become harmful.

As there are indications, as set out by Thomas[100], for example, that the treatment of poultry for helminths may not in all cases give beneficial results, the application of any measures which will prevent infestation becomes a very important factor in any worm control campaign associated with domestic birds.

In general, poultry are housed under either one of two systems of farm management, the intensive system or the free-range system. In the light of the knowledge which has been gained in this present investigation, the intensive system, both from the theoretical and practical standpoints, appears to lend itself more readily to helminth control than the free-range system. As the egg becomes infective in the minimum period of eight days, all that appears necessary, therefore, for the control of *A. galli,* where the housing is intensive, is the removal of the droppings at regular intervals of at least seven days. The floors in the houses must necessarily be of concrete or wood, which would permit a thorough removal of all fæcal matter.

As evidence of the degree of control which may be obtained through the adoption of this system some observations by Cuvillier and Jones[45] are of interest. These workers examined three groups of birds—(*a*) Group 1, which had been raised on concrete floors, and when adults confined to buildings with wooden floors; (*b*) Group 2, which had been raised on free range, and when adults confined as in Group 1 and (*c*) Group 3, which had been kept on free range throughout life. Comparing the worm burdens of each group it was found that 30 out of 40 birds were entirely free from worms in Group 1, whilst in Group 2 only two out of 40 birds, and in Group 3 only one out of 36 birds contained no worms.

Besides the removal of droppings at regular seven-day intervals, other measures which are considered to be of value in preventing infestation would be:—

1. Incubators should be given a thorough cleansing before use, and a boiling 5 per cent. disinfectant solution applied. All eggs should be carefully washed.

2. The young chicks should be confined in special brooder pens. These pens should be retained solely for the use of chicks. Concrete or wooden floors are desirable, concrete for preference, and these could be previously cleansed by the liberal application of a boiling 5 per cent. disinfectant solution.

Where it is found too expensive to put in floors of concrete or wood, brooder pens should be placed on soil on which poultry have never been present or have not been running for a number of years.

3. Special precautions should be taken with young birds till they are about three to four months old. For example, the use of a pair of goloshes slipped over the boots when entering a pen of young birds and retained solely for that purpose would be very desirable.

4. Food should be fed as far as practicable from hoppers. Drinking vessels should be of such a type as do not permit the surrounding soil being maintained in a state of constant dampness.

5. It would be advisable to give attention to all damp places in the yards, especially those in shaded positions. The yards and buildings should be kept clean and tidy.

6. Overstocking with the free range and semi-intensive systems is to be avoided. In the case of such animals as sheep, the rate of stocking depends largely on the available food. With poultry, on the other hand, the optimum number of birds per unit area is determined by the health of the birds and their productivity, and can be ascertained only by experience.

7. Rotation of runs and yards is advisable. Where possible yards, etc., should lie spelled from poultry for periods of at least one year.

8. Finally, the greatest consideration should be given to the ration employed. This should be well balanced, with adequate quantities of vitamins A and B and of animal protein. The closest attention should also be given to any other measures which would assist towards maintaining the birds in a good state of health.

Acknowledgments.

This investigation was largely dependent upon the financial assistance given by the Poultry Advisory Committee, Brisbane, to which the writer is duly grateful. Acknowledgment must also be made to Mr. J. Ladewig, late Experimentalist to this Station, for rearing the chickens used in the investigation; to Dr. H. R. Carne, McMaster Laboratory, Sydney, for his kindness in interpreting the histo-pathology of the experimental infestations; to Miss H. Newton Turner, Biometrician, McMaster Laboratory, and Mr. P. McGovern, of this Department, for the statistical analyses; to Mr. I. W. Helmsing, Illustrator, Entomological Branch, for the excellent illustrations and photomicrographs; and to the Poultry Branch of this Department for the assistance given by its officers at various times.

Summary.

1. An investigation has been made into the biology and control of the large roundworm of fowls, *Ascaridia galli*.

2. An examination of 579 birds from the Brisbane area showed the species to be present in 42·1 per cent.

3. A description of the fertile and infertile egg is given. The only other helminth egg with which the egg of *A. galli* could be confused in fæcal examinations of birds in Queensland is that of the cæcum worm, *Heterakis gallinæ*. Distinguishing features of the eggs of these two species are discussed.

4. The optimum temperature for egg development is 33°C. Fresh eggs may withstand temperatures as low as —7·5°C to —3°C for about seventeen days. Temperatures higher than 33°C. are eventually fatal.

5. Fresh and embryonated infectious eggs exposed to sunlight in a liquid medium did not survive for periods longer than three hours. When associated with conditions of desiccation no eggs survived exposure to sunlight for longer than two hours. Eggs in fresh normal-sized droppings allowed to dry out were killed in sunlight after fourteen days, whilst the presence of moisture increased their longevity to twenty-eight days.

6. Fresh and embryonated infectious eggs dried out on glass slides in the shade survived twenty-five, but not thirty, days. Eggs in fresh, normal-sized droppings allowed to dry out in the shade lived thirty-seven days.

7. The resistance of the egg to chemicals of possible use as ovicides was investigated. As a result of these trials it is recommended that a boiling 5 per cent. aqueous solution of a disinfectant with a relatively high tar-acid content be employed.

8. Studies on the longevity of the egg under laboratory conditions showed that in a tap water medium eggs may survive 368 days. Eggs in droppings exposed to natural conditions of rainfall, etc., survived 249 days in a shaded position and 103 days in a position constantly exposed to sunlight.

9. Studies on the life history of *A. galli* showed that under optimum conditions for development the egg may become infective in eight days. The infective stage is the second stage larva, the first moult occurring in the egg in about seven days.

Such infective eggs when fed to chicks hatch in the small intestine, the young larvæ being most frequent a few centimetres posterior to the entrance of the bile duct. For the first nine days the larvæ live freely in the lumen. From the tenth to the nineteenth day the larvæ attack the intestine tissues, and in general feed upon the epithelium lining the crypts. A few larvæ, however, may burrow more deeply into the tissues, and in rare instances may completely penetrate the bowel wall to subsequently occur in the liver, lungs, etc. After the nineteenth day, the larvæ again live freely in the lumen.

Three moults occur during the parasitic life cycle, five, twelve, and eighteen days respectively after infestation. The minimum maturity period observed was twenty-seven days.

10. Observations in the field, assisted by experiments in which birds were fed single and continuous doses of infectious eggs, have demonstrated that *A. galli* is a pathogenic helminth. The symptoms and lesions associated with infestation are described.

11. The resistance of the fowl to infestation was investigated, and it was found that under experimental conditions an age resistance and an acquired resistance could be demonstrated. Among old birds there is both a resistance to the worm itself and to its effects.

Age resistance experiments indicated that if birds could be reared under worm-free conditions till about four months of age they could then be turned on to infested soil with little subsequent ill-effects.

By virtue of this age resistance and assisted by a resistance developed as a result of continuous exposure to infestation old birds should therefore remain unaffected. An attempt to explain why this is not so under natural conditions, as based on Foster's work with *Ancylostoma caninum* in dogs and on Ackert's and Herrick's work on the effect of diet and repeated bleeding on the resistance of the fowl to infestation with *A. galli,* is that any condition likely to affect the health of the fowl makes it susceptible to infestation.

12. Both individual treatment and flock treatment trials were carried out.

Individual Treatment.—A series of tests with several drugs on young birds experimentally infested indicated that a very high efficiency could be secured with carbontetrachloride. Tests with this drug on naturally-infested adult birds confirmed these results. The effective dose rate is given as ·75 ml. per pound weight to a maximum dose of 2 ml., which dose rate is regarded as being reasonably safe. Starvation overnight is necessary for high efficiencies, but no after-starvation period is required. For the purposes of economy it is recommended that the drug be given by means of a syringe and rubber tubing, though higher efficiencies were secured in the young birds by the administration of the drug in capsules.

Two field trials with this drug were carried out on three-year-old birds over a period of eleven to thirteen weeks, and three treatments each of 2 ml. carbontetrachloride were given with an interval of three weeks between each treatment. Unfortunately no evidence of the existence of a heavy infestation in the birds used in either trial was obtained. Under the conditions of the experiments, however, it was found (1) that the handling and starvation associated with treatment did not affect production; (2) that treated lightly infested White Leghorn hens did not at any time reach the production of the untreated birds. The food consumption of the treated birds was also less; (3) in Australorps, in which the infestation was unknown, production was greater in the treated birds than in the controls. The treated birds, moreover, required less food to produce a dozen eggs; (4) treatment was effective against *Ascaridia galli.*

It was concluded that the drug as used in these experiments was not tolerated by the White Leghorns to the same degree as by the heavier Australorps.

Flock Treatment.—Nicotine sulphate mixed with the mash at the rate of ·5 ml. in 150 ml. water per pound of mash, and fed for a period of seven days proved very effective (82·5 per cent.) against *A. galli* under laboratory conditions. This mixture also gave an efficiency of 54.5 per cent. against *H. gallinæ.*

These efficiencies were confirmed by field trials in which four treatments were given at intervals of four weeks over a period of nineteen weeks. The results of these trials also indicated (1) that in the case of lightly infested light breeds treatment may have some toxic effects in so far as can be ascertained by egg production, but with heavily-infested light breeds the removal of the worms by treatment more than offsets any toxicity, so that egg production is increased, the amount of food required to produce a dozen eggs is decreased and the treated birds also convert more food into body weight; and (2) no ill-effects from treatment occurred in a heavy breed, in which the infestation was unknown, treatment resulting in an increased egg production.

Further trials are to be carried out in the field with both carbon-tetrachloride and nicotine sulphate. It would seem that where preventive measures are not enforced control by treatment can be secured only by the regular use of a vermifuge, the interval between treatments being such that the worms do not become large or numerous enough to be pathogenic. For such an experiment birds infested to a degree that their health is impaired are most desirable, otherwise any possible advantage of the removal of the infestation over any toxicity from treatment will not be shown.

13. Measures to prevent infestation are given and the advantages of the intensive system for the application of such measures are discussed.

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VAPOUR TREATMENT EXPERIMENTS FOR THE CONTROL OF BLUE MOULD OF TOBACCO.

Experiments with vapours for the control of blue mould of tobacco in seed-beds were carried out in Brisbane early last year, and have been discussed recently in a report prepared by the Tobacco Pathologist of the Department of Agriculture and Stock.

This method of disease control was developed some twelve months ago by the Council for Scientific and Industrial Research with experiments at Canberra and at various other centres. The most satisfactory results were obtained by evaporating benzol in vapour-tight seed-bed frames at a "normal" concentration, obtained when an area of liquid was exposed equal to 2 square inches for each square foot of seed-bed. In further experiments by the Council and by the agricultural departments of various States other volatile liquids such as toluol, petrol, and the proprietary material, "X3 Solvent," were tested, and in some cases concentrations other than normal were investigated.

In the Brisbane experiments the four materials, benzol, toluol, "X3 Solvent," as well as "X300 Special Boiling Point Spirit," were used at both the "normal" and half the "normal" concentration. In order to compare gas treatment with copper sprays some plots were sprayed with colloidal copper and soft soap. An attempt was also made to reduce the initial cost of equipment by using a special type of vapour-tight tent in place of the more expensive cold-frame for covering the seedlings during vapour treatment.

Although spores of the blue mould fungus were introduced into the seed-beds both by artificial and natural means, the gas-treated beds were successfully protected from the disease, and untreated plants contracted blue mould. This result was obtained with the four volatile liquids tested when used at both "normal" and half "normal" concentrations, and in glass-covered and calico-covered frames as well as in the special vapour-tight tent. Plants sprayed with colloidal copper became only slightly affected with the disease.

There was a tendency for plants treated with vapours to become stunted and pale. This was more pronounced when the higher concentration of vapour was used, and with benzol rather than with materials having a lower boiling point.

It was found that the rate of evaporation varied with the material used, the range of temperature experienced during the period of evaporation and also with the material used as a seed-bed covering, as well as the volume of the vapour-tight structure employed.

Experiments are now being carried out at several tobacco centres to confirm these results and to endeavour to evolve a more satisfactory type of vapour-tight tent.

Principles of Botany for Queensland Farmers.

(C. T. WHITE, Government Botanist.)

[*Continued from page 766, December, 1936.*]

CHAPTER XXIII.

Dicotyledons.

Subclass Archichlamydeæ.—Perianth either absent or rudimentary (as in the She-oaks or *Casuarinaceæ*), in one whorl or series (as in the Silky Oaks or *Proteaceæ*), or in two whorls, in which case the parts of the inner whorl (corolla) are free.

FAMILY CASUARINACEÆ (SHE-OAKS OR SHEOKES).

Casuarinaceæ is a small family of trees or shrubs. The leaves are reduced to minute teeth arranged in a whorl round the nodes. The number of these teeth in a whorl is an important aid to the identification of the various species. The branchlets are green, and function as ordinary leaves and form phylloclades or cladodes (see page 210) of a rather distinct type. The branchlets are usually grooved, with the stomata sunk in the grooves, transpiration thus being reduced and the trees adapted to a dry situation. The flowers are unisexual, and may be borne on the same or distinct trees. The males are arranged in slender cylindrical amenta at the ends of the branchlets. The structure is very simple. The flowers are arranged in whorls in the same way as the leaves; each male flower consists of a single stamen surrounded by two hood-shaped perianth leaves, which break off at their base as the stamen develops. Below the perianth leaves are two persistent bracts. The female flowers, like the males, are exceedingly simple. They are borne in heads or ovoid spikes (amenta) terminating in short lateral branchlets. Each flower consists of a single carpel subtended by a comparatively large bract and two bracteoles. The single ovary or carpel is surmounted by a style with two long, red, threadlike branches. The stigmas are pointed. The fruit or ripened carpel is a seedlike compressed nut with a smooth shining testa produced at the apex into a membranous wing enclosed within the enlarged and lignified persistent bracts and bracteoles, the whole inflorescence forming a compact woody cone.

The family is a small one, finding its greatest development in Australia and New Caledonia, in both of which countries the trees are a distinctive feature of the landscape. In Australia they are familiarly known as She-oaks or (to use the spelling adopted by the Victorian Naturalists's Club) Sheokes. Eight species are found in Queensland, among the commonest being the Swamp Oak (*Casuarina glauca*), which sometimes forms pure stands in the coastal brackish swamps of New South Wales and Queensland. The Belah or Belar (*C. lepidophloia*) is one of the characteristic trees of inland parts of all the eastern States; it is also found in South Australia and West Australia, but not to the same extent. It sometimes forms almost pure stands, but is more often associated with the Brigalow (*Acacia harpophylla*), producing the familiar Brigalow and Belah scrubs of many parts of Queensland. The Bull Oak (*C. Luehmanni*) is very widely spread through Queensland, and is, in fact, one of the most widely distributed species in Australia. It has a very distinctive sparse, upright growth, and is characteristic of a lot of sandy country a hundred miles or more inland in Queensland,

though it is also found nearer the coast. The Red Oak or Forest Oak (*C. torulosa*) is very common on better-class forest country throughout coastal Queensland and New South Wales. It is one of the principal fuel timbers of the State, and great quantities of it are used by bakers, being the favoured bread-baking fuel of coastal Queensland. The River Oak (*C. Cunninghamii*) has a wide range in New South Wales and Queensland, following the river and creek courses, and is a valuable tree for protecting river and creek banks. It is the largest member of the genus, and the wood is prized for the making of bullock yokes. Other species common are the Thready Bark Oak (*C. inophloia*), the Coast Oak (*C. equisetifolia*), and the Black Oak (*C. suberosa*).

FAMILY ULMACEÆ (THE ELMS).

The family *Ulmaceæ* and the two following—*Moraceæ* and *Urticaceæ*—are now regarded as three distinct ones. In older works on the Australian flora, such as the "Flora Australiensis" and Bailey's "Queensland Flora," they were all included under the one family—*Urticaceæ.*

The *Ulmaceæ* or Elms form a family of trees or shrubs with watery sap and with alternate simple leaves. The flowers are hermaphrodite or unisexual, the calyx is 4-8 lobed, the petals absent. The fruit is dry or thinly fleshy, and is often winged.

The species are mainly found in the temperate zone of the Northern Hemisphere, and the family is of relatively small importance in Australia. Of the Australian species, *Aphananthe philippinensis,* the Axe-handle Wood, or native Elm, is a small or medium-sized tree common in the rain-forests of coastal New South Wales and Queensland, and extending northward to the Philippine Islands.

Trema is a genus of trees and shrubs widely spread over the tropical and sub-tropical regions of the globe. *Trema aspera* is the Peach-leaf Poison Bush, the toxic character of which is due to the formation at irregular intervals of a prussic-acid-yielding glucoside.

FAMILY MORACEÆ (FIGS AND MULBERRIES).

Moraceæ, the family which contains the Mulberries and Figs, is composed of trees or shrubs, rarely herbs, usually exuding a milky sap. The leaves are alternate or rarely opposite, stipulate with sheathing bud-protecting stipules, the stipules in most cases early deciduous. The flowers are unisexual, and may be borne on the same or different trees. The calyx lobes are four or less, or sometimes absent. The petals are absent. The actual fruit is a small achene nut or drupe, the product of the ripened ovary; in the mulberries the rachis of the female inflorescence and the calyx lobes becomes fleshy, forming a composite fruit. In the figs the flowers are borne on the inner wall of a fleshy receptacle.

The family is a large one, widely spread over the world, but finding its greatest development in the tropics.

The largest genus is *Ficus,* which comprises the fig trees, which are characteristic features of nearly all dense tropical jungles or evergreen forests. There are about 600 species in different parts of the world, about sixty of which are found in Australia, and, with the exception of three or four, all in Queensland.

The majority of fig trees commence life as epiphytes, the seedlings growing in the fork of the branches, or in cracks or wounds, of various

other kinds of trees. Aerial roots are then sent out—first long, slender, flexible roots which, gradually growing longer and stouter, finally reach the ground. These aerial roots keep growing in thickness and strength, and branch and rebranch until they eventually form a lattice-like growth which crushes the life out of the tree on which the seedling fig has started its life. The tree gradually decays, and its rotting wood and bark afford food which is absorbed by the roots of the fig. The whole

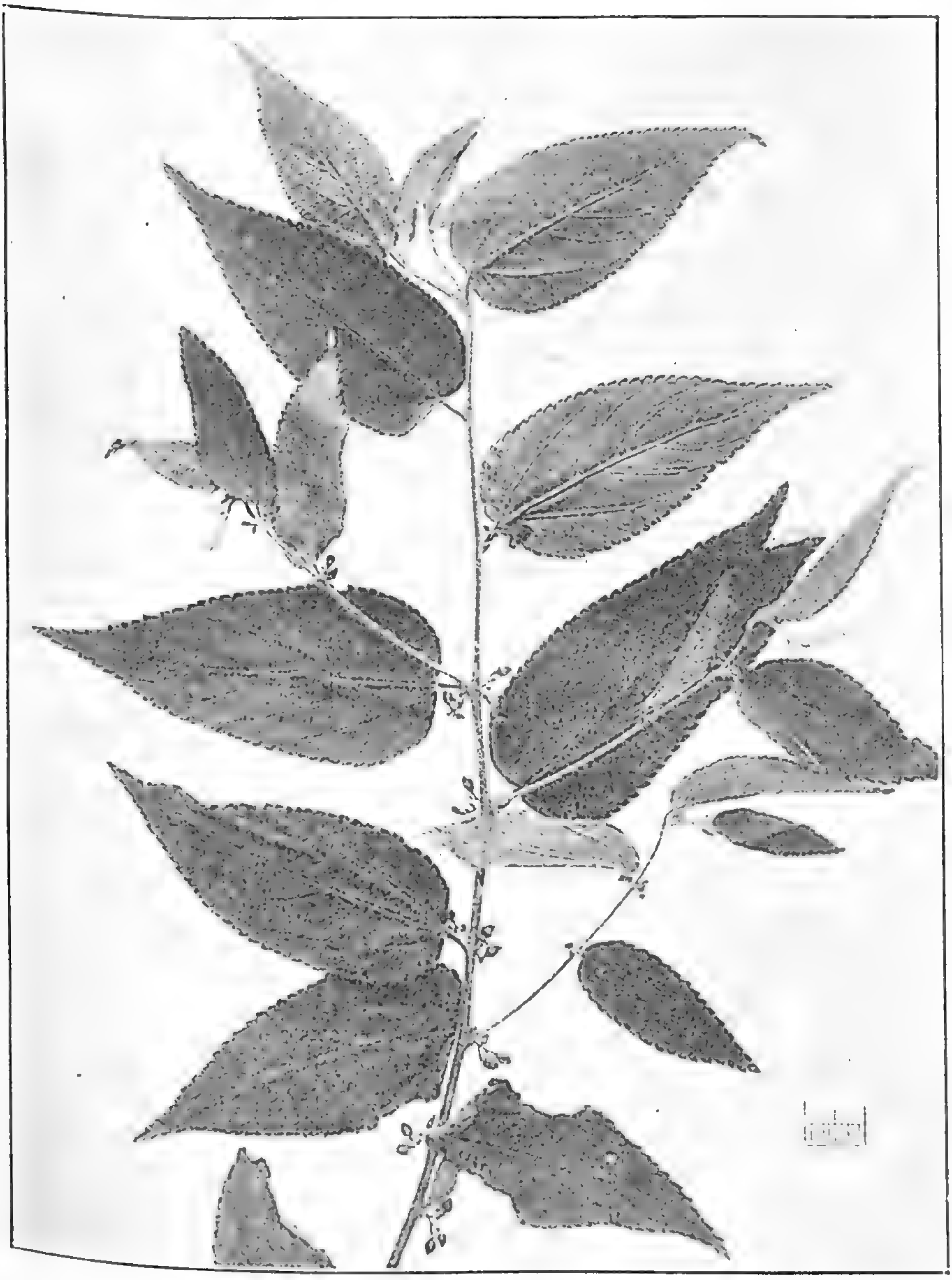

Plate 1.

PEACH-LEAF POISON BUSH (*Trema aspera*).—A common Queensland plant of the Elm family (*Ulmaceæ*).

of the trunk of most figs, with the exception of a small portion near the top of the tree, is thus formed of these aerial roots. Sometimes fig trees send from their branches roots straight down to the ground. These grow into stout column-like props, supporting the branch from which they spring. The branches keep on growing farther and farther out, every now and then sending down another prop-root, until a single tree in this way may eventually cover several acres. Fig trees that have this habit of growth are known as Banyans.

All species do not begin their life in the tops of other trees. A few, such as the common edible fig and the Cluster Fig, found in parts of Central and North Queensland, germinate in the ground in the ordinary way; also, species like the Moreton Bay Fig, which in their natural state start life high up in other trees, in ordinary horticultural and forestry practice are raised in flats or beds in the same way as other plants. The explanation, no doubt, lies in the fact that the young trees are "light-demanders."

The chief botanical characteristic of figs is that the flowers are borne on the inner wall of a closed receptacle. The receptacles are usually borne in pairs in the leaf-axils, but in some species may be borne on the larger branches and even on the trunk right down to the ground. A few tropical species bear the receptacles in clusters upon long branches that run over the surface of the soil and take root here and there. The flowers are unisexual, and there is also a class of neuter or abortive flowers known as gall flowers. The male and female flowers may be borne in the same or in different receptacles, in the latter case the gall flowers being associated with the males.

To understand the peculiar structure of figs, it may be mentioned that fertilization is dependent on the work of different species of fig-wasps, and the gall flowers are not the result of insect agency, but their peculiar structure rather determines the selection of them by the insect for the reception of its eggs. The gall flowers thus act as protectors to the seed-bearing flowers, which otherwise would probably be attacked by the fig-wasps, with the consequence that the grub afterwards developed would destroy the seed. The emergence of the pupa from the gall flowers takes place when the pollen is being shed from the male flowers, and the mature insect takes away with it a certain amount of pollen, which, somehow or other, is conveyed to the female flowers. It is thus seen that the gall flowers play an important part in the life history of the plant, not only protecting the female flowers from the attacks of the gall insects, but also insuring them later being pollinated by pollen from the male. Fig trees yield a rubber which varies in quality, according to the species yielding it. The only species of any commercial importance in this respect are the India Rubber Tree of India (*Ficus elastica*), and in a few species from tropical West Africa. The rubber formed from the juices of the common Moreton Bay Fig and other Australian species, so far as has been tried, has not proved to be of any commercial value. The inner barks of fig trees yield a strong fibre much used by the aborigines in the manufacture of twine, string-bags, fishing-nets, &c. The wood of fig trees is generally light and not very durable; hence it is only used for case-making and similar purposes.

Other important genera are *Morus* and *Artocarpus*. The former includes the Mulberries. The Black Mulberry (*Morus nigra*) is very abundant in cultivation in Queensland. The White Mulberry (*Morus alba*) possesses a fruit of very poor quality, but is extensively planted

in Southern Europe and other countries for silkworms, the silk produced being reputed of better quality than when the Black Mulberry is used as the food plant.

Artocarpus includes the Bread-fruit (*A. incisa*), very common throughout the Southern Pacific and an important article of food among the natives and the Jak (or Jack) Fruit (*A. integrifolia*), grown to a limited extent in Queensland. The true Bread Fruit is not to be confused with the Pandanus tree—common along the coast and often called "Bread fruit" by Queenslanders.

Family Urticaceæ (The Nettles).

The Family *Urticaceæ,* as now recognised, is a comparatively small one of herbs, shrubs, or soft-wooded trees often armed with stinging hairs. The leaves are simple, alternate or opposite. The flowers are unisexual, the calyx lobes 4 or 5, petals absent; in the female flowers the calyx often becomes enlarged and fleshy in fruit. The fruit is a dry achene or fleshy drupe.

Nine genera occur in Queensland, one containing trees. The family contains the Stinging Nettles, the genus Urtica, of which two species are very common in Queensland—the one *Urtica incisa,* a common herb or small shrub on "scrub" (rain-forest) edges in Queensland, the other the common English Nettle, *Urtica urens,* naturalised and common in South-Eastern Queensland, particularly on the Darling Downs, and in the cooler parts of the State generally.

The genus Laportea is widely distributed through the tropical regions of the world, and three species occur in Australia—all in Queensland. The Giant Stinging Tree (*Laportea gigas*) attains the dimensions of a very large tree; another—the Shining-leaf Stinging Tree (*L. photiniphylla*)—is a medium-sized tree; while the third—*L. moroides* (the Gympie)—is only a shrub. The characteristic feature of the trees is the irritating sting they inflict when brushed against the naked skin. This irritation varies in intensity with the different species. In some of the Laporteas the effects of the sting may last for months, being noticeable every time cold water comes in contact with the flesh.

When examined closely, the leaves of the Stinging Trees are seen to be clothed with innumerable minute hairs, with here and there larger ones scattered among them. These larger hairs take the form of hollow brittle tubes, and are filled with a strong acid. They usually arise from a raised mound or cushion and taper gradually to the apex. They are terminated by a small head, which breaks off at the lightest touch. When the sharp, broken point of the hair pierces the skin, it pours out the strong acid contained in the hollow part of the hair.

Family Proteaceæ (Silky Oaks).

Proteaceæ is a family of woody plants of very characteristic structure. The leaves are mostly alternate, rarely opposite or whorled, and are simple or variously divided. The flowers are mostly hermaphrodite, though sometimes unisexual. They have only the one series of perianth segments. In Bentham's "Flora Australiensis" and Bailey's "Queensland Flora" the floral parts are simply referred to as perianth segments. In his "Families of Flowering Plants," Hutchinson regards them as sepals or calyx lobes. Some authors regard them as petals, basing their decision on the similarity of the flowers to those of their close allies,

the *Loranthaceæ* or Mistletoes. On the other hand, Hutchinson may be right, and perhaps the hypogynous glands represent a very modified corolla. Under these circumstances of doubt, it is perhaps perferable to use the term "perianth segments," as adopted by Bentham, Bailey, and others. The perianth segments are four in number, and are usually united into a tube in the bud stage and variously split when open. The stamens are epipetalous—*i.e.*, attached to the petals and appearing as if they had grown out of them—rarely free. The ovary may be sessile or narrowed into a stalk (called the stipes) at the base. The fruit is various, being a nut, drupe, follicle, or capsule. The seeds are without endosperm, and in the follicular fruits are usually winged.

The family is a large one of about 1,000 species, distributed through fifty genera widely spread over the world, but poorly represented in the Northern Hemisphere and finding its greatest development in Australia and South Africa, particularly in the former country, where about 650 species are found. About 300 are found in South Africa, and the few remaining species are scattered over the Pacific Islands, New Zealand, South America, and tropical and temperate Asia.

The distribution of the family is rather remarkable. It reaches its greatest development in South Africa and Australia, but none of the genera are common to the two countries. South America, on the other hand, possesses two genera common to Eastern Australia and to the mountainous regions of West South America. Of these two genera, *Lomatia* has three species in South America and six in Australia; *Embothrium* has four species in South America and one or several in Australia, according to the view taken of the genus; *Helicia* is one of the few genera that extends to the Northern Hemisphere, several species being found in the southernmost islands of Japan. It is quite common in Eastern Australia, extending from the far North southwards to the Northern Rivers district of New South Wales.

To the Queenslander, the main interest in *Proteaceæ* arises in the beauty and value of the timbers, several of which are cut and sold indiscriminately under the name of Silky Oak. In previous years the familiar *Grevillea robusta* provided all the Silky Oak of the trade, but now practically all comes from various North Queensland trees—mostly *Cardwellia sublimis.* The outstanding feature of the wood is the great width and depth of the medullary rays, which give rise to the characteristic oak figure when the timber is radially or quarter cut, as is the general practice in Queensland with fancy timbers such as the Silky Oak and Maple.

The original Silky Oak of the Australian trade was the product of *Grevillea robusta* of South-eastern Queensland and Northern New South Wales. In Southern Queensland and in New South Wales a certain amount of the timber of *Orites excelsa* was also cut. In Queensland, this tree is found at altitudes of 2,000 feet and over. It is very well developed in the Killarney district, and is sometimes known as Killarney Oak. The commonest Silky Oak of the trade at present is *Cardwellia sublimis*, a large tree of the North Queensland rain-forests.

Silky Oak seasons well and rapidly, and is one of the most workable and ornamental of cabinet woods. It can be carved, veneered, bent, glued, and stained or polished with equal readiness. It is light, but firm and strong, and holds nails better than most timbers In North Queensland it is used for general building purposes, even as weather-boards, and generally for doors and window sashes.

Macadamia is a genus of three or four species confined to Eastern Australia, and finding its greatest development in Queensland. The principal characteristic of the genus is its fruit, consisting of a coriaceous pericarp split into two valves and enclosing one or sometimes two seeds. The seeds are enclosed in a very hard, bony, usually brown, and shining testa. The leaves are verticillate, opposite or alternate, toothed or entire. The flowers are borne in slender, either simple or branched racemes. The best-known species is *M. ternifolia*, the common Macadamia Nut, Queensland Nut, or Australian Bush Nut, unquestionably one of the finest flavoured nuts in cultivation. Many forms have been recognised, and the tree shows considerable promise as an economic nut producer. A remarkable feature about this tree is that, though it is a native of Southern Queensland and Northern New South Wales, and normally found in heavy rain-forest country with 45 to 70 inches of rainfall, the leaves remind one, by their leathery nature, of a xerophytic rather than a mesophytic type, and the tree has been found in cultivation to be fairly drought-resistant.

The seeds of two other species of the genus—namely, *M. minor* of South-East Queensland and *M. Whelani* of North Queensland—both contain a prussic-acid-yielding glucoside, and are only edible after the glucoside has been destroyed by washing and heat. Another species—*M. praealta*, the Ball Nut of South Queensland—is common in parts of the Tweed Bay district. It is rather different from the other species of Macadamia in general appearance; the seed is not known to possess any poisonous properties, though it has an exceedingly bitter taste, which renders it of no value as a nut producer.

FAMILY LORANTHACEÆ (THE MISTLETOES).

The Loranths or Mistletoes are shrubs parasitic on trees or are very rarely erect terrestrial trees. The leaves are mostly opposite, and are sometimes reduced to scales. The flowers are hermaphrodite or unisexual, and are often brightly coloured; the perianth is double (*i.e.*, with a calyx and corolla) or apparently single by suppression of the calyx limb. The calyx-tube is adnate to and encloses the ovary. The petals are 4 to 8, free or united, stamens as many as the petals, opposite to them and usually epipetalous. The fruit is a berry with a solitary seed devoid of testa.

Loranthaceæ is a large family estimated to contain about 500 species, most of which are tropical and sub-tropical. The family is represented in Australia by about fifty species. Strange to say, none occur in Tasmania.

Mistletoe are parasites, or, rather, partial parasites, which live upon many kinds of trees, deriving their water supply and mineral food constituents from them. By means of green leaves or branchlets they can make the whole or at least part of their organic food by photosynthesis (see pages 617 and 619), though they probably obtain some organic food needful for their life from the host. The plants enfeeble the branches of the trees upon which they are parasitic, and are directly injurious by allowing the entrance of destructive insects and fungi at the swollen cankered places which are often produced where they take root.

The only method of eradicating and diminishing the attacks of Mistletoes is by cutting off the infested branches. Breaking off the branches of Mistletoes is of little or no use, as it usually only stimulates adventitious growth.

2

Mistletoes vary a good deal in regard to their choice of hosts. Some species show distinct preferences in this respect; others attack numerous species of trees indiscriminately. *Notothixos subaureus* is almost invariably parasitic on other species of Mistletoes. Sometimes there is a close similarity in general facies of the parasite to its host, thus *Loranthus linophyllus* is almost invariably found growing on *Casuarina*, and *L. pendulus* on *Eucalyptus*. Most are quite dissimilar to the host tree. Some are found on a number of trees, but favour some kinds more than others. *L. Bidwillii* I have not seen on trees other than Cypress Pines (*Callitris* spp.). *L. congener* is very common on most trees, but favours *Casuarina*. *L. vitellinus* is very common on most trees, but favours *Tristania suaveolens* (Swamp Mahogany).

The fruit of Loranthus is a one-seeded, commonly somewhat transparent berry. The seed is enclosed in a viscid and rather sweet pulp, which, when exposed to the air, dries rapidly. Birds carry the seed from tree to tree. Although numbers of seeds pass through the alimentary canal of the birds, a greater portion are rejected after having their exterior covering removed. These falling may adhere to branches, and in a short time become firmly cemented on the upper surface and sides.

The germination and life history of one of the common Australian Mistletoes (*Loranthus exocarpi*) has been studied by C. C. Brittlebank, and his observations published in the "Proceedings of the Linnean Society of New South Wales" (Vol. XXXIII.). The following notes are based on his work.

Seeds which have passed through the alimentary canal of birds germinate as readily as those which have fallen directly from the parent plant. If the seeds fall on larger branches covered with a thick layer of dead bark, they are unable to penetrate to the soft underlying cortex, and perish; owing to this fact, Mistletoes are generally found to start life upon thin limbs or on branches which have clean, tender, and sappy bark. The embryo runs through the longer axis of the seed, and is completely surrounded by a store of plant food (albumen), the whole of which—both embryo and albumen—is stained green by chlorophyll. The germination period varies greatly, in some cases the seeds starting to germinate within one or two days, but in other cases germination may be delayed for a couple of months. Germination having begun, the hypocotyl emerges from a terminal pore which up to this time it had filled, somewhat after the manner of a stopper in the neck of a flask. The hypocotyl may bend downward towards the branch, but in many cases it bends upwards and over the seed, reaching the branch behind. As the axis of the embryo lengthens, it becomes covered by little processes. The extremity of the hypocotyl becomes enlarged, club-shaped, and papillose. This and the clavate processes exude a clear liquid, which plays a most important part in the life of the plant. This fluid comes in contact with the bark of various plants, at once penetrating its structure, softening and partly dissolving the cellulose matter, and at the same time cementing the apex of the radicle, which now becomes flattened and disklike, to the branchlet of the host. The end of the hypocotyl now becomes rapidly enlarged, spreading out into a hemispherical mass. The cells of the distal surface grow out and enter the host as papillæ. The cotyledons may remain within the seed-coat or be carried up, in this case commonly acting as protective leaves to the young plumule. As soon as penetration of the host is effected growth becomes very rapid. It often happens that before much leaf-growth is made a

large tubular aerial root is thrown out from the sucker, and this root grows rapidly along the branch, soon seeking the under side. Here and there along these lateral aerial roots large suckers arise from which roots of the parasite penetrate the host. As growth develops, a wedge-shaped root or sinker passes down into the wood of the host, which it penetrates in various ways, according to the species of Loranth and the nature of the host wood which it invades.

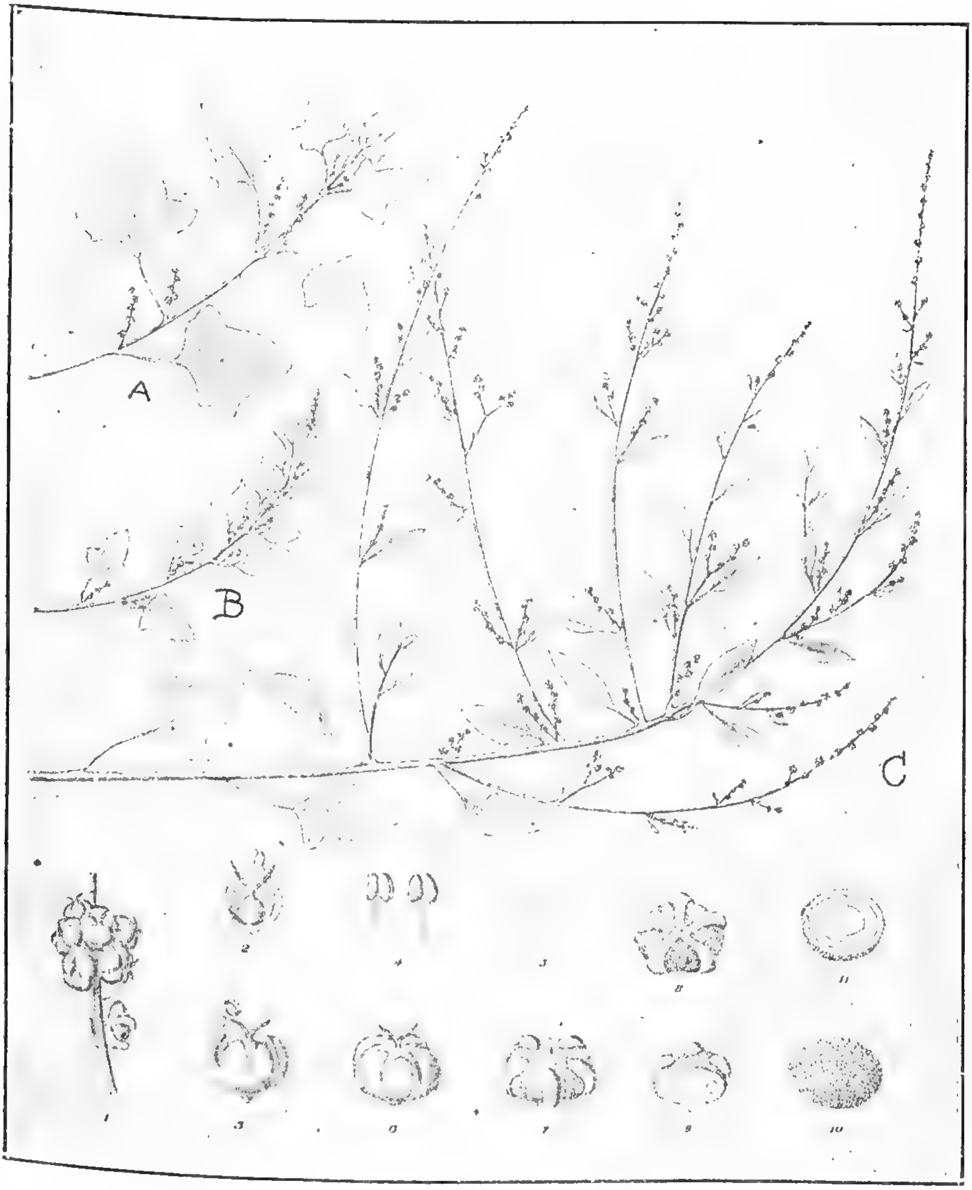

Plate 2.

GOOSEFOOT (*Chenopodium triangulare*), R. Brown. A very common plant of the Salt-bush Family (Chenopodiaceæ) A, B, and C.—Shoots somewhat reduced.

1.—Portion of branchlet bearing flowers.
2.—A flower, part of the calyx removed.
3.—A flower.
4.—Back and front view of a stamen.
5.—Pollen grain.
6.—A young fruit.
7 and 8.—Mature fruits (seeds).
9.—Longitudinal section of a fruit.
10.—A seed.
11.—Transverse section of seed.
1-11.—Variously enlarged.

(*After Mueller in "Iconography of Australian Salsolaceous Plants."*)

FAMILY CHENOPODIACEÆ (SALTBUSH FAMILY).

Annual or perennial herbs or shrubs. Leaves usually alternate. Flowers small, commonly green and insignificant, hermaphrodite or unisexual. Sepals 5, persistent, and often enlarged in fruit. Petals absent. Stamens 1-5. Ovary superior. Fruit, a seedlike nut.

The family is of most interest to the Australian farmer and pastoralist, on account of the number of edible shrubs (top-feed) and herbs it contains. Most of these are familiarly known as Saltbushes.

The edible Saltbushes belong to several distinct groups or genera, the three most important being *Atriplex, Chenopodium,* and *Rhagodia, Atriplex,* the largest, is widely spread over the warmer regions of the globe, but in countries other than Australia the species are mostly confined to sandy lands near the sea. *Atriplex nummularia* is the Old Man Saltbush, a shrubby species extensively planted both as a fodder plant and as a hedge. One of the commonest and most widely spread in Queensland is *A. Muelleri,* mostly known as the Annual Saltbush or Saltweed, a species that comes up in tremendous abundance following both autumn and spring rains. It grows to a height of 18 inches to 2 feet. Considerable divergence of opinion exists as to its palatability, but, on the whole, stock seem to reject it when other feed is available, though they will eat it at times, particularly when it is drying off.

Widely spread in different parts of the State, and particularly common on cleared Brigalow and Belah country on the Darling Downs and in the Maranoa district, is the Creeping Saltbush, *A. semibaccata.*

The genus *Chenopodium* is a large one. The species occur in different parts of the world—mostly as weeds of cultivation. In England and America they are frequently referred to as Goosefoots, owing to the common shape of the leaves being like the foot of a goose, but in Queensland the various forms of Fat-hen belong to the genus *Chenopodium,* the commonest being *Chenopodium album.*

In addition to the ones growing as introduced weeds, there are twelve native species, and some of these are of considerable value as fodders. Perhaps the best is the Blue Bush, *C. auricomum,* an upright growing species of the interior, mostly about 3 feet high, and producing a large amount of edible leaf.

Rhagodia is very similar to *Chenopodium* in general appearance, but has small, fleshy fruits, those of *Chenopodium* being quite dry. One of the Rhagodias—namely, *R. hastata*—is commonly used as a hedge plant, and some beautiful hedges of it can be seen about Toowoomba and other parts of the Darling Downs.

All the Saltbushes are not good fodders. The family is a very large one, and some of them are common weeds, more especially plants of the genus *Bassia,* several of which are common pasture weeds in Queensland. The best known is perhaps the Galvanised Burr, *Bassia Birchii.*

Important vegetables belonging to this family are the Beetroot, *Beta vulgaris,* and the Spinach, *Spinacia oleracea.* The Silver Beet mostly cultivated in Queensland as Spinach is a variety of the common Beetroot, *Beta vulgaris.* It is regarded by some botanists as a distinct species. *Beta Cicla.*

FAMILY ANNONACEÆ (CUSTARD APPLE FAMILY).

A family of trees, shrubs, or woody climbers. Leaves alternate, simple, entire. Flowers sessile or pedicellate, solitary or clustered. Sepals 3, usually free, but sometimes united into a toothed or lobed calyx. Petals mostly 6, sometimes 3 or 3 large and 3 much reduced. Stamens numerous, closely packed on the thickened torus or floral receptacle. Pistil usually composed of numerous carpels, free and distinct from one another. Fruit composed of several free carpels (berries) or a syncarp, as in the Custard Apple and its allies, formed by the growing together of the carpels and floral receptacle into a fleshy mass.

The family is widely spread over the tropical and sub-tropical regions of the world. A number of species are natives of the rain-forests or jungles of coastal Queensland. The most important genus, from an economic standpoint, is *Annona,* which contains the Custard Apple, *A. squamosa,* the Cherimoya, *A. Cherimola,* the Sour Sop, *A. muricata,* and the Bullock's Heart, *A. reticulata.* Most of the species of *Annona* come from tropical America. The name is usually spelt "Anona," but W. E. Safford, an American botanist, who has paid particular attention to these fruits, says the correct spelling and the one adopted by Linnæus (see page 748) is "Annona."

FAMILY LAURACEÆ (LAUREL FAMILY).

Lauraceæ is a family of trees or shrubs with alternate leaves, or in one genus—*Cassytha*—reduced to leafless parasitic twiners. The flowers are small, hermaphrodite or unisexual, and borne in panicles, though sometimes in racemes or spikes. The perianth tube is short; the lobes are usually six in number, but vary from three to six. The stamens are 3-9, or indefinite; the anthers open by valves. The fruit is a berry or drupe; the perianth entirely deciduous, as in *Endiandra,* or the tube enlarged and cup-shaped under the fruit, as in *Litsea* and *Cinnamomum,* or entirely closing over and adnate to it, as in *Cryptocarya.* The seed is ex-albuminous (see page 386 and plate 176), with large cotyledons.

The family is a large one, containing about 1,000 species distributed through forty genera, mainly tropical, but extending to the temperate regions of both the Northern and Southern Hemisphere. About fifty species are found in Australia, and all of these, with the exception of one or two members of the parasitic genus *Cassytha,* are found in Queensland. With the exception of the genus *Cassytha,* the species are all trees. They are common in Eastern Queensland and Northern New South Wales, and in many cases represent a fairly large percentage of the trees in the rain-forests or jungles.

The Laurels, though they represent a fair proportion of the trees in many of the rain-forests of coastal Queensland, yield only a few important as timber species. The most important is the North Queensland Walnut, *Endiandra Palmerstoni.* This is one of the largest and commonest trees of North Queensland, and a good deal of the timber, particularly of the walnut butts for veneer manufacture, has been exported abroad, largely to the United States.

The family contains the Avocado (*Persea gratissima* or *P. americana*), a native of tropical America now widely cultivated in tropical and sub-tropical countries. A peculiar feature that has been much studied of late is the sex-reversal of the one-day flowers. Some flowers mature the male organs (the stamens) first, and the female organ (the

pistil or gynæcium) later. These are known as protandrous flowers. Others have the reverse action, the pistil maturing first and the anthers later. Such flowers are called protogynous. The flower types of numerous commercial varieties have been worked out by Dr. A. B. Stout, of the New York Botanic Gardens. The value of this work to the orchardist is that an intermingling of the protandrous and protogynous types should result in a bigger fruit crop than the one type alone.

FAMILY CRUCIFERÆ (THE CRUCIFERS OR CABBAGE FAMILY).

A family of annual, biennial, or perennial herbs. Leaves simple, alternate, or, more rarely, opposite. Flowers mostly arranged in racemes. Sepals 4, petals 4, or in a few cases absent. Stamens 6, two shorter than the other four. Pistil or gynæcium simple. Fruit an elongated pod (often termed a siliqua) or short pod (often termed a silicule), bi-valved or indehiscent.

Cruciferæ is a large family, finding its greatest development in the temperate regions of the world. Its useful members include many vegetables, as the Cabbage (*Brassica oleracea*), Turnip (*Brassica Rapa*), Radish (*Raphanus sativus*), Cress (*Lepidium sativa*), Water Cress (*Nasturtium officinale*), &c. It contains many garden flowers, as Stocks (*Matthiola*), Wallflowers (*Cheiranthus*), &c. Some of the species are very common weeds of cultivation and pasture land in Queensland; most of them give a very objectionable odour and flavour to milk and cream. They are familiarly known as Mustard or Turnip Weeds.

FAMILY PASSIFLORACEÆ (THE PASSION FRUITS).

A family of climbers or, more rarely, trees. Leaves alternate, often with glands on the leaf-stalk. Flowers mostly hermaphrodite, sometimes unisexual. Sepals 5, free or partly united. Petals 5, rarely absent. A corona is present, usually composed of one or more rows of threadlike filaments, sometimes annular or composed of scales. Stamens 5 or more, ovary 1-celled, with several parietal placentas (see page 376) and numerous ovules. Fruit a berry (or, rarely, a capsule); seeds numerous, with a pitted surface.

Passifloraceæ is a family widely spread over the tropics and subtropics of the world. It includes the common Passion Fruit (*Passiflora edulis*), the Granadilla (*Passiflora quadrangularis*), the Banana Passion Fruit (*Tasconia mollisima*), and other species less frequently seen, as the Yellow or Sweet Granadilla (*Passiflora ligularis*) and the Sweetcup (*Passiflora laurifolia*). Several native species are found in Queensland, the two commonest being *Passiflora Herbertiana* and *P. aurantiaca*, which contain a prussic-acid-yielding glucoside (see page 614), and may cause the death of cattle that eat heavily of them. The White Passion Vine (*Passiflora alba*) is very common in many localities, especially as secondary growth on cleared country, growing over old logs in fallen scrub and in the better-class forest country. In times when grass is scarce, particularly towards the end of spring and beginning of summer, the young shoots are eaten by stock. Repeated tests of the leaves of Queensland material for the presence of a prussic-acid-yielding glucoside have given negative results; so some other poisonous body must be the cause of the trouble experienced with this plant. Feeding experiments with this vine were carried out by the late Dr. Sydney Dodd, and his results published in the "Queensland Agricultural Journal" for February, 1910. The symptoms as described

Plate 3.

Tumbling Mustard (*Sisymbrium orientale*).—A plant of the Cabbage family or Cruciferæ.

by him are certainly not those of prussic acid poisoning, for a feature brought out by the investigation was that the poisonous property of the vine is of a cumulative nature, and evidently quite considerable quantities of it have to be eaten before any ill-effects are noticed. This accounts for the fact that no cases of poisoning are heard of in many localities where stock are habitually running in paddocks overrun with the vine.

FAMILY CARICACEÆ (THE PAPAW AND ITS ALLIES).

A family of soft-wooded (almost herbaceous) trees or shrubs. Leaves alternate, usually digitately lobed or divided and clustered towards the tops of the trunk or branches. Flowers unisexual, borne in panicles, the male panicles usually large, females small and few-flowered. Male flower: Calyx 5-lobed; petals 5, united in the lower part into a slender tube; stamens 10; a rudimentary ovary may or may not be present. Female flower: Calyx 5-lobed; petals 5, united or at length quite free from one another. Ovary superior, with parietal placentation. Fruit a large berry, usually with numerous seeds, but the ripe seeds sometimes few or entirely absent in cultivated plants.

The family is a small one of about fifty species, natives of tropical America. The largest genus is *Carica,* the fruits of several species of which are edible. The most important economic species is the common Papaw (*Carica Papaya*), widely cultivated throughout the tropics and sub-tropics of the world as a fruit.

FAMILY CUCURBITACEÆ (THE CUCURBITS OR MELON AND CUCUMBER FAMILY).

A family of herbaceous or woody climbers or prostrate creepers, the tendrils spirally coiled. Leaves alternate, variously lobed. Flowers unisexual. Calyx 5-lobed or toothed. Corolla gamopetalous or of five free petals. Stamens 1-5, usually three; one anther always 1-celled. Ovary inferior. Fruit a berry; seeds usually flattened and numerous.

The family is widely spread over the world. Many of the species are important crop plants, such as the Pumpkin (*Cucurbita Pepo*), Cucumber (*Cucumis sativus*), Rock Melon (*Cucumis Melo*), Water Melon (*Citrullus vulgaris*), &c.

FAMILY GUTTIFERÆ (MANGOSTEEN FAMILY).

Guttiferæ is a family of trees or shrubs. Leaves opposite, without stipules, sometimes with translucent oil or resin dots. Flowers variously arranged—single, in clusters, or in cymes or panicles; unisexual or hermaphrodite. Sepals 2-6, free or slightly united. Petals 2-6. Stamens numerous, free or united at the base into one or several bundles. Ovary superior, stigmas radiating out from the top of the ovary, or united; sessile or with a distinct style. Fruit a berry (*Garcinia*) or drupe (*Calophyllum*).

The family is entirely tropical and contains the Mangosteens (genus *Garcinia*). Five native species occur in Queensland. The common Mangosteen of the East, rarely grown in Queensland, is *Garcinia Mangostana.* An inferior species (*G. Xanthochymus*) is sometimes cultivated in North Queensland gardens. Another genus is *Calophyllum,* represented in Queensland by three species, one of which (*C. inophyllum*) is much grown as a street and esplanade tree in North Queensland. It is widely spread over the Indian, Malayan, and Pacific regions. It is

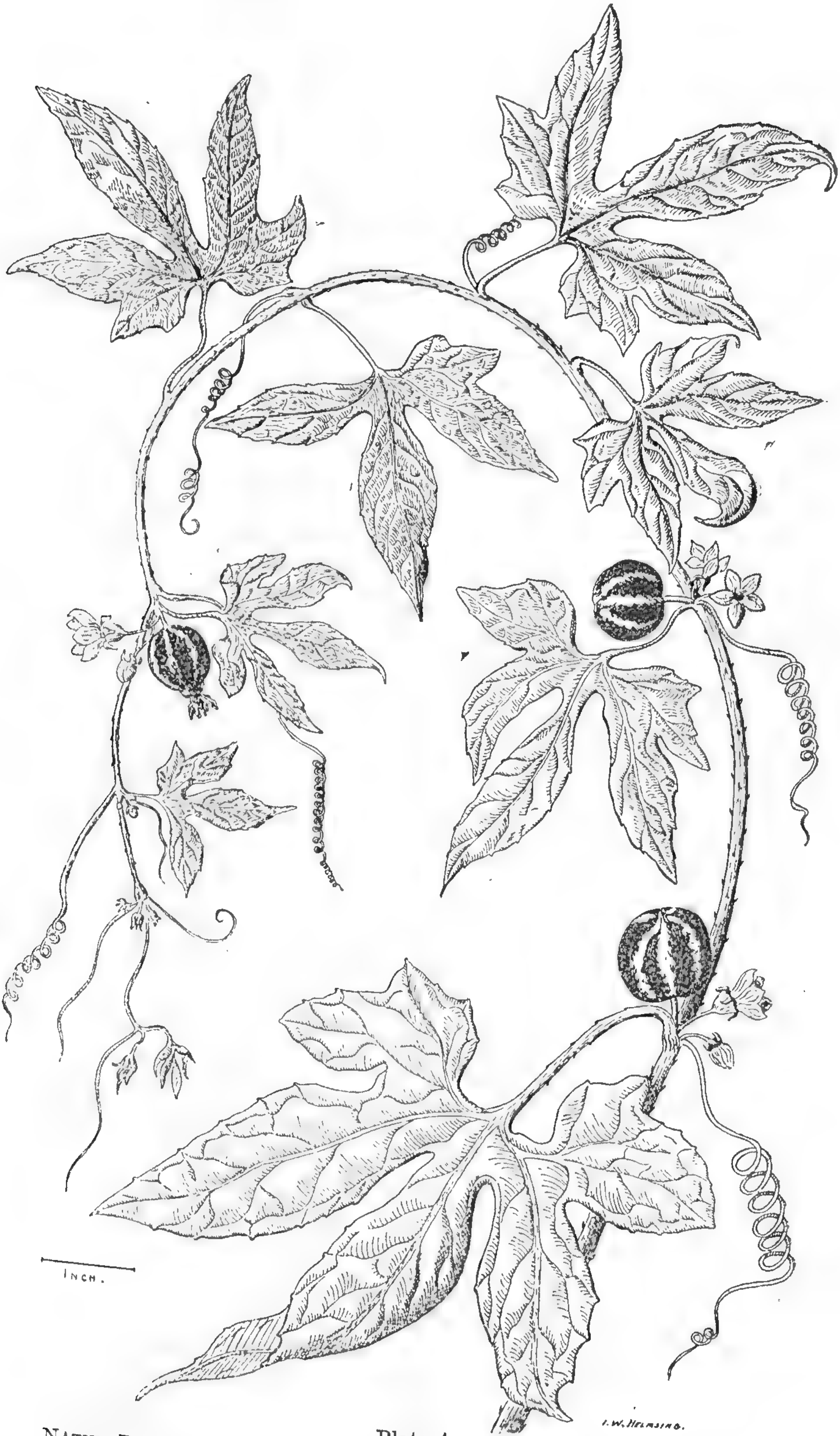

Plate 4.

Native Bryony (*Bryonia laciniosa*).—A native vine of the Family Cucurbitaceæ.
The fruits are red with white wavy lines, and are poisonous.

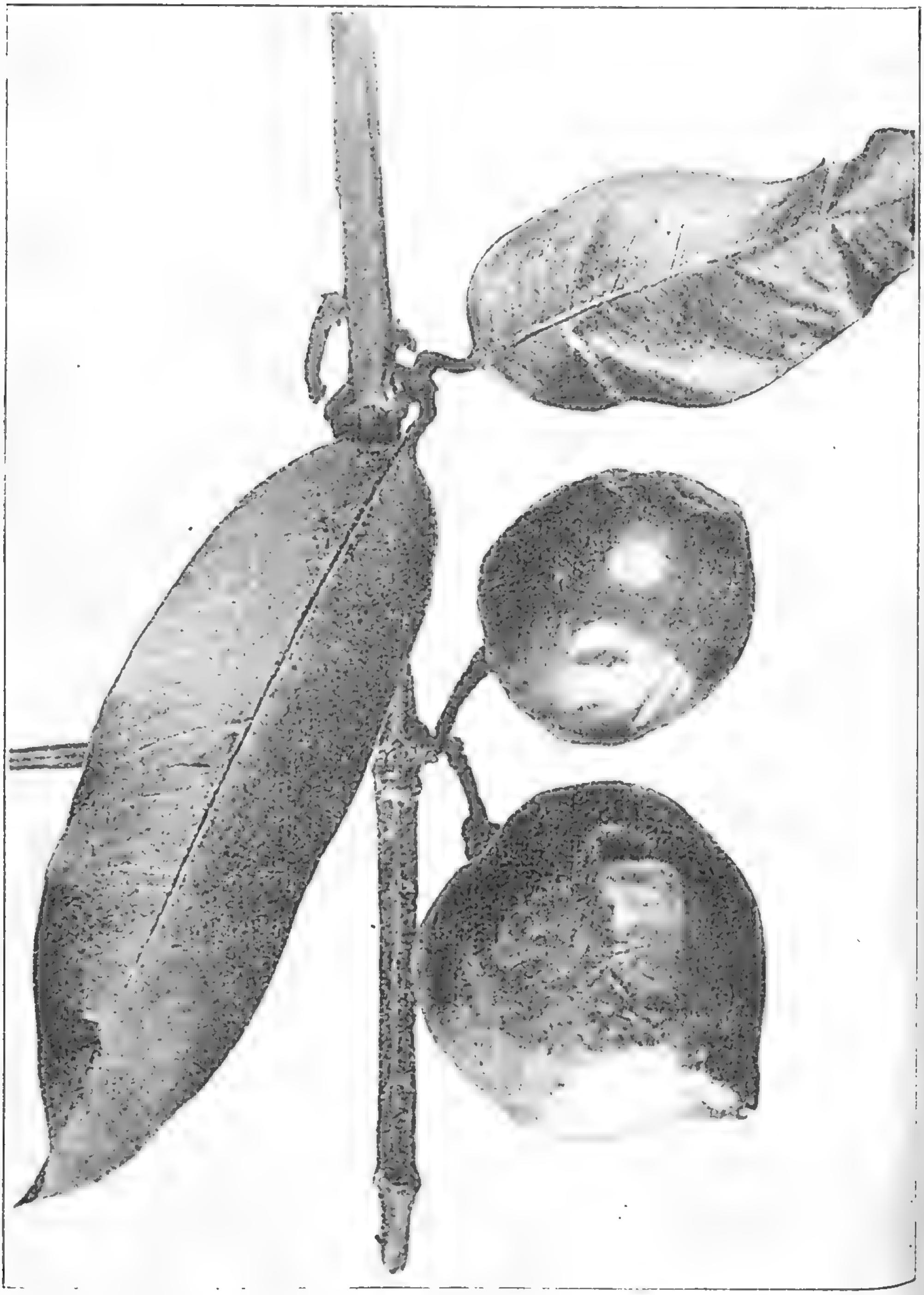

Plate 5.

FAMILY GUTTIFERÆ (*Garcinia Xanthochymus*).—An inferior mangosteen grown to a limited extent in North Queensland.

sometimes known as the Alexandrian Laurel. Another species (*C. costatum*) is confined to North Queensland. The timber under the name of *Calophyllum* is extensively used for general building purposes.

FAMILY MALVACEÆ (THE MALLOW FAMILY).

A family of herbs, shrubs, and trees, usually with a fibrous bark. Leaves alternate, stipulate, but the stipules sometimes soon falling and

only seen in the bud stage. Flowers mostly hermaphrodite, sometimes unisexual. Sepals 3-5, in some genera, such as *Hibiscus* and *Gossypium* (cotton), surrounded by a ring of bracteoles (called an epicalyx). Petals 5, free, but often joined at the base to the staminal column; stamens numerous, joined together in a staminal column; anthers 1-celled. Ovary 2-many-celled. Fruit a dry capsule or breaking up into cocci or mericarps (see Plate 170).

The family is widely distributed over the world. Some are very common farm weeds in Queensland— *e.g.*, "Sida retusa" (*Sida rhombifolia*), Button Mallow (*Modiola*), &c. Several are cultivated as ornamental shrubs, particularly members of the genera *Abutilon* and *Hibiscus*. Both these latter are well represented by native species in the Queensland flora. The bark of many yields a strong cordage. The most important economic genus is *Gossypium*, which includes the Cotton (*G. herbaceum*) and Sea Island Cotton (*G. barbadense*).

FAMILY STERCULIACEÆ.

A family of herbs, shrubs, or trees, very closely allied to the Mallows, differing chiefly in the 2-celled—not 1-celled anthers. The leaves are much lobed and divided or entire.

The calyx is 3-5 toothed or lobed. Petals 5, reduced to small scales or entirely absent. Ovary 2-5 celled, the carpels united or more or less distinct. Fruit either a capsule or composed of a number of distinct follicles as in *Sterculia* and *Brachychiton*.

The family is a fairly large one, finding its greatest development in the tropics. It is well represented in the Queensland flora, the largest genus being *Brachychiton*, which contains the Kurrajong (*B. populneum*), the Northern Kurrajong (*B. diversifolium*), the Bottle Tree (*B. rupestre*), Broad-leaved Bottle Tree (*B. australis*), the Flame Tree (*B. acerifolia*), and other trees. The genus is separated from *Sterculia* on very slender grounds, but as most recent works on the Australian flora retain it, I have followed suit. The most readily observable distinction is that the seeds and inside of the capsule are smooth in *Sterculia* and hairy in *Brachychiton*.

Sterculia quadrifida is very common, and is often known as Peanut Tree. The fruits are bright red when ripe, and the seeds a dull black with an edible kernel. The only other species of *Sterculia* in Queensland is *S. laurifolia*, a common tree in some of the North Queensland jungles or "scrubs."

FAMILY RUTACEÆ.

The family *Rutaceæ* consists of trees, shrubs, or, more rarely, herbs with simple or compound glandular-dotted leaves. The flowers are mostly regular and 4- or 5-merous. The ovary is superior, the carpels free or united. The fruit is various, being a berry, as in *Citrus*, a drupe, as in *Halfordia* or Saffron Heart, a samara, as in *Pentaceras*, the Bastard Crow's Ash, or a capsule, as in *Flindersia*, Crow's Ash, Maple, &c.

Rutaceæ is a very large family estimated to contain about 700 species widely spread over the world, mostly in tropical and sub-tropical countries. The family is strongly represented in Australia, and contains one of our most important genera of timber trees—namely, *Flindersia*. In the "Queensland Flora" and older works of Australian authors this genus is included in the *Meliaceæ*, but more modern authors have generally classed it along with *Rutaceæ*. Its glandular-dotted leaves and, on

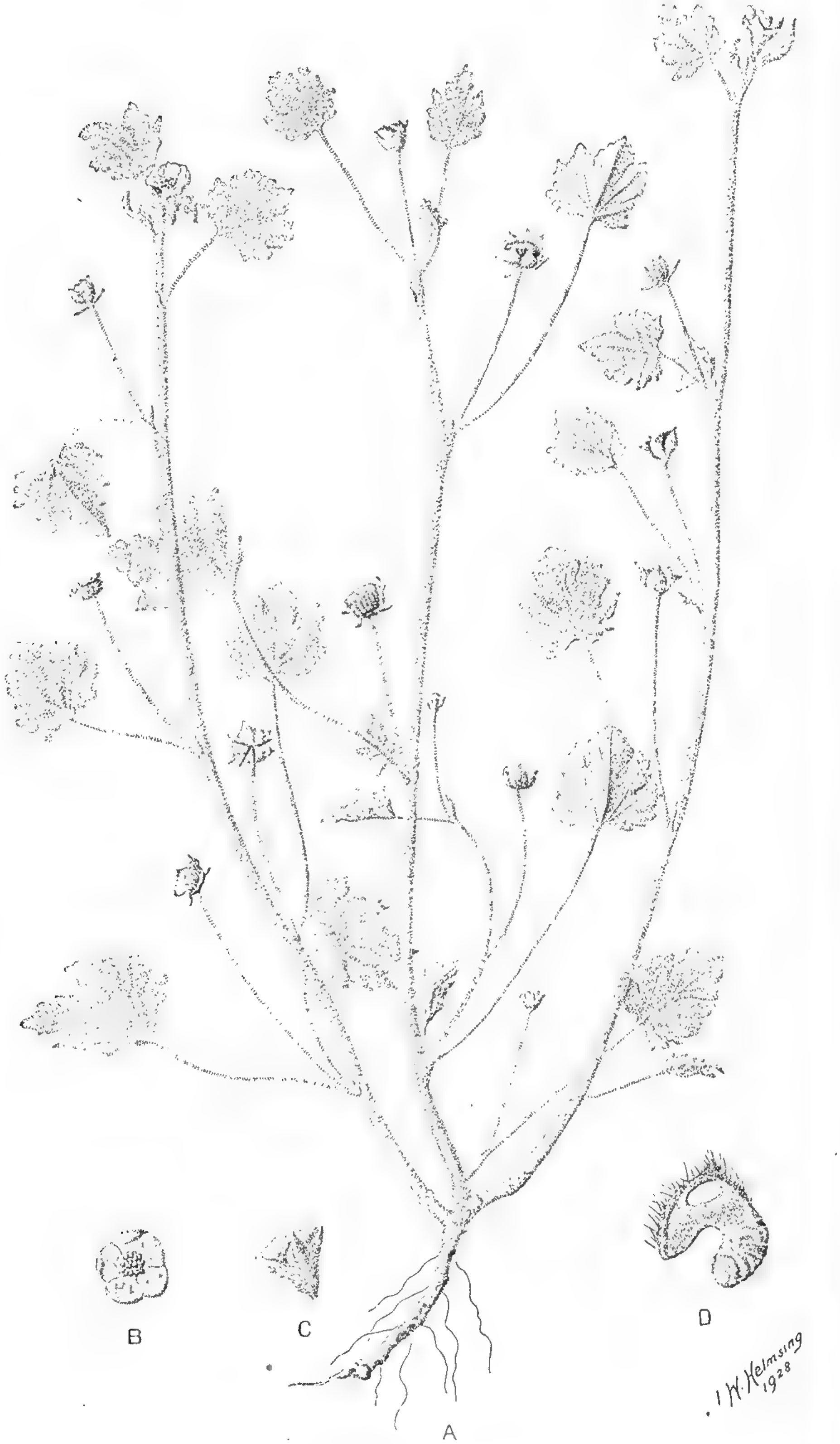

Plate 6.

BUTTON MALLOW (*Modiola caroliniana*).—A member of the Mallow family (Malvaceæ).

A. Plant about half natural size. B. Single flower (face view). C. Single flower (back view). D. Ripe carpel or mericarp containing seeds.

the whole, its timber structure place it in this family rather than in the *Meliaceæ*. In some respects the characters belong in part to both families, and perhaps a new family to receive it should be made.

The family contains the *Citrus* fruits, as the Orange (*Citrus aurantium* or *C. sinensis*), Lemon (*Citrus limonum*), Grape Fruit (*Citrus grandis*), Kumquat (*Fortunella japonica*), Citron (*Citrus medica*), &c. Several citrus fruits are natives of Queensland; they have been separated from *Citrus* proper by W. T. Swingle, an American botanist, under the generic name of *Microcitrus,* on the grounds of their dimorphic foliage (the leaves on juvenile plants being different from those on the adult), their small flowers with free—not united—stamens, and their few-celled fruits with stalked pulp vesicles. Four species have been described—the Native Orange (*M. australis*), the Finger Lime (*M. australassica*), the Russell River Lime (*M. inodora*), and Garraway's or the Peninsula Lime (*M. Garrawayi*). Another tree of the *Citrus* group, a native of Queensland and of New South Wales, is the so-called Desert or Western Lime (*Eremocitrus glauca*).

FAMILY ANACARDIACEÆ.

A family of trees or shrubs. Leaves mostly alternate, simple or compound. Flowers unisexual or hermaphrodite. Petals 3-7, sometimes absent. Stamens the same number as or twice the number of petals, rarely indefinite or reduced to one fertile, the remainder small and abortive. Ovary one to several celled. Fruit superior or semi-superior, usually a fleshy drupe, or in one or two genera dry or nearly dry and seated on a fleshy and much enlarged fruit-stalk or pedicel.

The family finds its greatest development in the tropics. It is represented in Queensland by seven native species. These include the Burdekin Plum (*Pleiogynium Solandri*), the Tar Tree (*Semecarpus australiensis*), Deep Yellowwood (*Rhodosphaera rhodanthema*), and North Queensland Bolly Gum (*Blepharocarya involucrigera*). Many of the species possess a blistering sap, as the Tar Tree and the North Queensland Bolly Gum. One of the worst offenders in this respect is the Poison Ivy (*Rhus toxicodendron*), an ornamental climber only rarely seen in Queensland gardens. This vine colours well in autumn in colder places, but, as many people are affected very badly by contact with it, it is unwise to plant it, especially as other vines are available. In plants causing skin irritation individual idiosyncracy enters largely into the degree of infection.

Of cultivated fruits the most important is the Mango (*Mangifera indica*), a native of India cultivated throughout the tropics and subtropics of the world. The Cashew Nut of the West Indies and tropical America is *Anacardium occidentale.* The pericarp contains a blistering, resinous, poisonous sap, but the kernel is edible, as is also the enlarged fruit stalk on which the fruit is seated.

FAMILY SAPINDACEÆ.

A family of trees, shrubs, or climbers, the climbing members sometimes herbaceous. Leaves alternate, mostly compound. Flowers unisexual or rarely hermaphrodite. Sepals 4 or 5, free or united into a toothed or lobed calyx. Petals as many as the sepals or calyx lobes, sometimes one less in number, and at times minute or entirely absent, frequently bearing scales on the inner face. Stamens usually 8. Ovary

superior, most commonly 3-celled. Fruit a capsule. Seeds usually with an arillus, which is sometimes showy and sometimes pulpy and edible.

The family is a large one, finding its greatest development in the tropics. It is well represented in the Queensland flora, particularly among the smaller or medium-sized trees of the rain-forests or jungles of the coastal belt. One of the most widely distributed native species is the Boonaree or Western Rosewood (*Heterodendron oleæfolium*), frequently cut as fodder during times of drought. It develops at times a prussic-acid-yielding glucoside, and on this account hungry stock should not be allowed to feed too heavily on the freshly cut foliage. Among the commonest forest shrubs are the various species of *Dodonæa*, generally known as Hop Bushes. Their dry, winged seed-capsules have been used as a substitute for hops. The bark, leaves, and pods of several *Sapindaceæ* possess a saponin, and for a short time a small industry was worked up in the collection of the bark of *Jagera pseudorhus*, a handsome native tree familiarly known as Foam Bark, as a substitute for Quillaja bark, imported for heading ales and stouts; the rather erratic distribution of the tree, however, prevented the continuance of the work. Quillaja bark itself is the product of *Quillaja saponaria*, a native of South America, and a member of the family *Rosaceæ*.

A feature of the seeds of several *Sapindaceæ* is the development of a large, fleshy aril (see page 385, plate 175), often of an acid or agreeable distinctive flavour. The best known is the Litchi (*Litchi chinensis*). Others less frequently seen away from the eastern tropics are the Rambutan (*Nephelium lappaceum*) and the Longan (*Euphoria Longana*). The seeds of the native Tamarinds (*Diploglottis* and *Arytera*) possess a very acid, watery pulp.

FAMILY VITACEÆ (GRAPE VINE FAMILY).

A family of woody climbers or rarely erect shrubs, stems often articulate (*i.e.*, easily broken or detached) at the nodes. Leaves alternate. Flowers small in racemes, panicles, or cymes opposite the leaves. Peduncles (or inflorescences?) often metamorphosed into tendrils. Calyx small, entire or 4-5-toothed or lobed. Petals 4-8. Stamens 4-5 opposite the petals. Ovary usually immersed in or surrounded by the disk. Fruit a berry, often with a watery pulp.

The family is a large one widely spread over the tropical and warm temperate regions of the world. It is represented by about twenty native species, one of which (*Leea sambucina*), is a large, straggling shrub common in shrubby hillsides near the sea. Some of the native species, both in the stems and leaves and fruits, contain needles of calcium oxalate, and cause considerable irritation when bitten or chewed. The common European grape is *Vitis vinifera*. The genus *Vitis* is particularly well developed in North America; the species which has been most improved is *Vitis labrusca*, which has also been hybridised to some extent with *V. vinifera*. Other American species that have been used for improvement and hybridisation are *V. æstivalis* and *V. rotundifolia* (Muscadine). A feature of American grapes is their resistance to phylloxera, which makes them of importance as stocks in many grape-growing areas.

FAMILY ROSACEÆ (ROSE FAMILY).

A family of trees, shrubs, or herbs. Leaves simple or compound, alternate. Flowers usually hermaphrodite. Calyx mostly enclosing the

ovary. Lobes 5. Petals 5. Stamens from twice as many as the petals to indefinite. Ovary of one to many carpels. Fruit various, frequently a drupe, as in the "stone" fruits—Peach, Plum, &c. The pome characteristic of "pomaceous" fruits—Apple, Pear, Quince, &c.—is formed from the enlargement of the torus or floral receptacle (see page 370), the carpels being embedded in the middle, each surrounded by its thin bony or leathery pericarp. The "hip" of the rose is composed of the hollowed and enlarged floral receptacle enclosing in this case a number of achenes (the true fruits). In the Strawberry (*Fragaria*) the floral receptacle enlarges and becomes fleshy after fertilization, the true fruit being the achenes embedded near the surface. The Blackberry, Raspberry, Loganberry, &c. (genus *Rubus*), possess flowers somewhat similar in structure to those of the Strawberry, but the floral receptacle, instead of becoming enlarged and fleshy, remains comparatively small; the carpels themselves, however, develop into small, succulent drupes (sometimes called "drupels").

Fruits such as the Apple, Rose hip, Strawberry, &c., in which parts other than the ovary itself go to form the fruit, are often termed false fruits. Other examples are the Fig, Pineapple, and Mulberry (see page 381). The Blackberry, Raspberry, &c., represent true fruits, as the parts which give succulence to the fruits is the fleshy pericarp of each little drupe or drupel.

The family *Rosaceæ* is a very large one widely spread over the world, but finding its greatest development in temperate regions. It includes many fruits, as the Apple (*Pyrus Malus*), Pear (*Pyrus communis*), Plum (*Prunus domestice*), Cherry (*Prunus cerasus*), Peach (*Prunus persica*), Almond (*Prunus amygdalus*), Quince (*Cydonia vulgaris*), Loquat (*Eriobotrya japonica*), Strawberry (*Fragaria vesca*), Blackberry (*Rubus fruticosus*), &c.

The family contains many of the common garden shrubs cultivated in Queensland—*e.g.*, Hawthorn (*Cratægus*), May (*Spiræa*), Indian Hawthorn (*Raphiolepsis*), *Photinia*, Rose (*Rosa*), &c.

It is poorly represented in Australia, the native Queensland members consisting of two trees—the Nonda Tree (*Parinarium Nonda*) and *Pygeum Turnerianum*, both of North Queensland, five species of *Rubus* (Native Raspberries or brambles), and two species of *Acæna* (Sheep-burrs).

FAMILY LEGUMINOSÆ (THE LEGUMES).

The family *Leguminosæ* is characterised mostly by the fruit being a typical legume (see page 378). The plants composing it may be trees, shrubs, or herbs; the leaves vary from simple to bipinnate; the flowers regular to irregular (see pages 372-3); the petals are free or may be partly united; stamens few or many, free or variously united; the carpels are superior, and, except in one or two genera, are solitary; the fruit is a legume; the cotyledons are large and the seeds without endosperm. A feature of legumes is the development of bacterial root nodules. These bacteria that are present in the soil, and are particularly abundant in soils that have previously carried a leguminous crop, enter the tissues through the root-bark and set up the formation of the characteristic galls or nodules. By means of this bacterial association the plant is enabled to obtain nitrogen from the air, other plants not so affected having to rely for their supply of nitrogen upon nitrates and ammonia salts in the soil.

The family is of world-wide distribution. It is divided into three well-marked sub-families regarded by Hutchinson, the English botanist, in a recent work, as three distinct families:—

(1) *Mimosoideæ* (family *Mimosaceæ*);

(2) *Cæsalpinioideæ* (family *Cæsalpiniaceæ*);

(3) *Papilionatæ* (family *Papilionaceæ* or *Fabaceæ*).*

In the *Mimosoideæ* the leaves are mostly bipinnate, rarely simply pinnate, and in one genus (*Acacia*) reduced mostly in the adult plants to phyllodes (see page 228). The flowers are regular; petals valvate in the bud—often small; stamens as many as the petals, twice as many or indefinite, free or monadelphous.

In the sub-family *Cæsalpinoideæ* the leaves are bipinnate, simply pinnate, or rarely simple. The flowers are irregular or rarely regular; petals imbricate in the bud, the upper one never outside and usually quite inside, or in a few genera some or even all four of the lower petals wanting. Stamens usually 10, sometimes few, rarely indefinite, free or more or less united.

In the sub-family *Papilionatæ* the leaves are simple or simply pinnate; the flowers are very irregular; the petals are imbricate in the bud, the upper one on the outside. In this sub-family the upper and outer petal is called the standard or vexillum, the two side petals the wings, or alae, and the two lowermost petals form the keel or carina. Stamens usually 10, all free, monadelphous or diadelphous.

The indigenous flowering plants of Australia number approximately 10,000 species. The family *Leguminosæ* is numerically the largest family, containing approximately 1,100 species.

In the sub-family *Mimosoideæ* the most important genus is *Acacia*, which contains about 500 species widely spread over the tropics and sub-tropics of the world, and finding its greatest development in Australia, between 350 and 400 species occurring here. It is the largest genus of Australian flowering plants.

The Australian species belong to two groups—

(1) *Phyllodineæ,* in which the leaf function is performed by phyllodes, the true leaves dropping off at an early stage in the plant's development;

(2) *Bipinnatæ,* in which the leaves are all pinnate.

The first is by far the greater in Australia. The group is almost entirely Australian, only a very few being found elsewhere. A few are found in the Western Pacific, and one (*Acacia mangium*), common in North Australia, extends northward to the Malay Archipelago. One species (*Acacia Koa*—the source of the famous Koa wood) is a native of the Hawaiian Islands. A discussion on the development of the *Acacia* phyllode will be found on page 228.

* The usual practice is to base the name of the family on the first named genus in it. This is usually deviated from in certain families, such as the *Leguminosæ*, the *Umbelliferæ*, and the *Compositæ*, though even here some botanists prefer to use the names *Fabaceæ*, based on *Faba*, the Broad Bean, *Ammiaceæ*, based on *Ammi*, the Bishop's Weed, and *Asteraceæ*, based on *Aster*, respectively, for these three families.

One of the main features of Australian wattles from an economic standpoint is the importance of the bark of several species as a source of tannin. Australia, in the barks of its indigenous wattles, possesses one of the richest, if not the richest, source of tannin in the world. The use of wattle bark is on the increase, and in England the bark and the tan extract, along with other extracts, are largely taking the place of older tanning substances, such as oak bark, which were previously used.

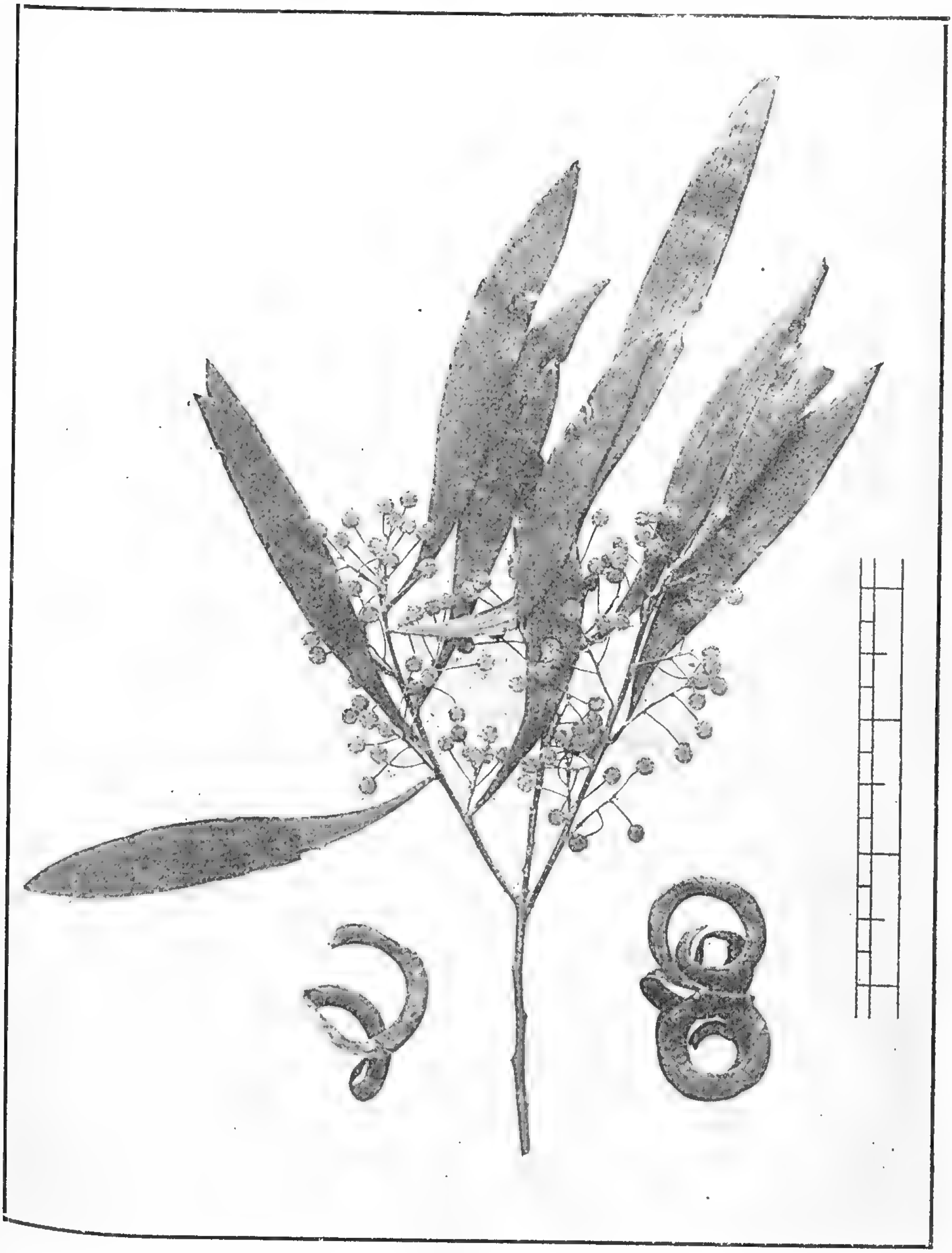

Plate 7.

Broad-leaved Sally Wattle (*Acacia implexa*).—A common tree in coastal Queensland. It is a member of the Sub-family Mimosoideæ of the Leguminosæ.

The wattle yielding bark richest in tannin is the Golden Wattle of South Australia (*Acacia pycnantha*), commonly known in commerce as "pycnantha wattle." It is a native of South Australia, Victoria, and New South Wales. It has been introduced into Queensland at various times, but is not particularly suited for cultivation here on an extensive scale. It is mostly a shrubby species 12 to 14 feet high and a few inches in diameter. The next richest wattles in tannin content, but still more important from the actual amount of wattle bark used at the present time are the *Acacias* or wattles of the *decurrens* groups—*i.e., Acacia decurrens* and its varieties and allied species. The most important of these is *Acacia mollissima* (syn. *A. decurrens* var. *mollissima*), which occurs in all the Eastern States, including Tasmania. It is very rare in Queensland, but in Tasmania is the only form.

In speaking of tan barks, Mr. A. R. Penfold, Curator, Technological Museum, Sydney, stated recently in an address before the Royal Society of New South Wales that unfortunately the story of the wattle-bark industry is a very sad one for Australia. About fifty years ago South Africa established wattle-bark plantations from seed collected in Australia. To-day 300,000 acres are under plantation in that colony. Tan bark and tannin extract to the value of £1,000,000 are exported annually. Mine props bring in an additional £500,000 per annum, and wattle cultivation ranks fourth in the Union's agricultural industry.

The treeless, grassy highlands of Natal are specially suitable for wattle culture, and the tree can, therefore, be grown in rows and economically tended to, while the necessary bark sheds and appurtenances can be placed in the most advantageous position. Moreover, there is an abundance of cheap and efficient native labour available for employment on the plantations.

Although there is an import duty of £3 per ton, it does not seem to have afforded very great encouragement for the cultivation of the wattle in Australia. The prevailing rate of exchange has greatly assisted the industry during the past ten years.

The total production of tan barks in Australia is estimated at 27,000 tons.

The cultivation of wattle for the production of bark cannot be too strongly recommended, and, unless early steps are taken to retrieve the position, it looks as if the industry has passed to South Africa for all time. The South Africans have been studying the position very thoroughly, so much so that they are now planting from selected trees. It has been found that certain trees have thicker bark than others, and, as it has been shown that the thicker the bark the greater the concentration of tannin, it is perfectly obvious that it is only a matter of time when their plantations will consist solely of these selected trees very rich in tannin.

The timber of the wattles is, as a rule, hard and heavy, but very beautiful. The species producing the timber of the greatest value is *Acacia melanoxylon*, Blackwood, one of the most important cabinet woods in Australia. The majority of the species are natives of the open forest or interior parts, but a few occur in the coastal rain-forests. One of these is *Acacia Bakeri*, the Marble Wood, a light-coloured timber with a beautiful grain. It is now being used to a limited extent in railway carriage work. Some of the species occur on rain-forest edges very abundantly, sometimes almost as pure stands as secondary growth

after the forest or scrub has been cleared. Some of the species are gregarious, particularly in the interior parts, forming particular types of scrub, such as the Brigalow, Lancewood, Mulga, Gidgee or Gidyea, Yarran, and Bendee scrubs of Western and Northern Queensland. Boree (*Acacia homatophylla*) occurs sometimes as pure stands, but more often as individual trees or scattered clumps.

The majority of wattles are small trees, only a few producing mill logs; the woods of some, however, on account of their distinctive beauty, are in demand for the manufacture of small fancy articles. Some of the woods now used extensively are Mulga (*Acacia aneura*), Bendee (*Acacia* sp., perhaps a form of *A. aneura*), and Myall (*Acacia pendula*).

Albizzia is a genus of about fifty species widely spread over the tropics. It is closely allied to the bipinnate Acacias, but differs in the petals being united in the lower part. Of the six Australian species, one is found in Western Australia, the others in Queensland. The tree colloquially known as "Acacia" in the Queensland sugar-belt is a species of *Albizzia* (*A. procera*). Another species extensively planted in the Central-West and familiarly known as "Acacia" is *A. Lebbek,* a native of India.

Erythrophlœum Laboucheri, Red Ironwood or Poisonous Ironwood of North Queensland, is a tree of about 50 feet high with exceptionally hard, heavy wood. The leaves are extremely poisonous, and cause a good deal of trouble at times on this account among stock in North Queensland and the Northern Territory.

The sub-family *Cæsalpinioideæ* is not very well represented in the native flora. The largest genus is *Cassia,* some of the members of which are cultivated as garden trees and shrubs. Several are native and others are naturalised weeds. *C. fistula,* the Indian Laburnum, is very common in Queensland gardens, particularly in the coastal North. The long, cylindrical pods are familiarly known as Cascara Beans, and the sweetish pulp that surrounds the seeds is a mild purgative. It has no relation to the true Cascara of commerce, which is obtained from the bark of a North American tree (*Rhamnus Purshiana*). *Cassias,* on the whole, possess purgative properties, and the dried leaves of several are the familiar Senna leaves of commerce.

The genus *Bauhinia* is represented by several native species, very shapely trees, mostly natives of the inland parts of the State, and several rather showy, flowering, cultivated ones.

Belonging to this sub-family is the Tamarind (*Tamarindus indica*), a native of India extensively cultivated in North Queensland. Tamarind pulp is imported for use in the manufacture of sauces such as Worcestershire sauce.

Papilionateæ is a large sub-family represented in Australia by a number of plants found nowhere else, and many of which are among the brightest of our native flowering shrubs. Few of them reach tree size.

Castanospermum is a genus of several species containing the Bean Tree or Moreton Bay Chestnut (*C. australe*), a native of the rain-forests or vine scrubs of coastal Queensland and New South Wales. In more open country it is common along river and creek banks, usually associated with River Oak, River Tea-tree, and other typical riverside trees.

Plate 8.

ARSENIC BUSH (*Cassia laevigata*).—A native of tropical America now a common naturalised weed in most warm countries. It is a member of the Sub-family Cæsalpinioideæ of the Leguminosæ.

The timber is one of the most handsome of our cabinet woods, but, owing to its wide sapwood and the faulty nature of the large trees, it is rather less widely used than it might otherwise be. The seeds are poisonous to stock, causing severe gastro-enteritis. The sub-family contains some important vegetables, such as the Pea (*Pisum sativum*), French Bean (*Phaseolus vulgaris*), Lima Bean (*P. lunatus*), Soy Bean (*Glycine hispida*), Cowpea (*Vigna catjang*), Peanut (*Arachis hypogœa*), Broad Bean (*Faba vulgaris*), and the Lentil (*Lens esculentus*).

The genus also includes many valuable pasture plants, such as the clovers and trefoils, and numerous native herbs.

FAMILY MYRTACEÆ (THE MYRTLES).

Myrtaceœ is a very large family of trees and shrubs with fairly constant characters. The leaves are always simple, with an entire margin, and, examined under a lens through transmitted light, are seen to be pellucid-dotted. The flowers are hermaphrodite; the calyx-tube is usually more or less joined to the ovary; the lobes 3 or more; petals 4-6; stamens from the same number as the petals to very numerous. The ovary is usually inferior, but in a few species is half-superior or almost wholly superior. The fruit is a dry capsule or a one or several seeded berry. It is on this nature of the fruit that the family is divided into two sub-families, viz., sub-family *Leptospermoideœ* (capsular or dry-fruited forms) and sub-family *Mytoideœ* (berry-fruited forms).

The family contains nearly 3,000 species widely spread over the world, but finding its greatest development in tropical and sub-tropical countries. It is represented in Australia by nearly 1,000 species, and is numerically the second largest family of Australian flowering plants, the largest being Leguminosæ with approximately 1,100 species.

The most important genus economically in Australia and probably in the world is *Eucalyptus*. The Eucalypts of Australia, according to the latest monograph by W. F. Blakely, the leading authority on the genus, number a little over 600 species.

The Eucalypts comprise a very natural group with special botanical characteristics. The leaves of most species are dimorphic—*i.e.*, of two distinct types—(*a*) the leaves which occur on young trees and stump shoots, usually referred to as "sucker" leaves, though coppice leaves, I think, is a more correct term (Maiden, Blakely, and several other botanists refer to them as juvenile leaves); and (*b*) the leaves in the adult tree, usually referred to as secondary or adult leaves. The former often differ markedly from the adult forms, sometimes being much larger, sometimes much narrower, and less frequently show little differences from them. They are sometimes opposite and horizontally placed and supposed to represent the original type of Eucalyptus leaf, the vertically placed leaves on the older tree having arisen in response to the dry conditions that gradually became more prevalent in a good many parts of Australia.

Eucalyptus is very distinct in its floral character. The flowers are apetalous, and the calyx lobes are welded together into a small lid or operculum which covers the essential parts of the flower in their young stages and falls off and exposes them on maturity. In one species common in Queensland—namely, the Spotted Gum (*Eucalyptus maculata*)—the operculum is double, the inner operculum being of fine

Plate 9.

VIGNA LANCEOLATA.—A Native legume common on Downs country. It represents a plant of the Sub-family Papilonatæ of Leguminosæ.

A. Part of plant. B. Calyx. C. Standard. D. A wing petal. E. A peel petal. F. Ovary. G. Seed. All figures natural size.

texture, and possibly representing a corolla. The ovary and calyx tube in which it is borne are welded together, and eventually develop into the capsule. The number of cells in the capsule varies from three to seven, and when ripe each cell opens at the top by a small valve.

The outstanding economic feature of the genus is the value of its timbers, Eucalyptus being the most important genus of hardwood trees in the world. On this account they have been largely planted in all warm and sub-tropical countries.

The extraction of the oil from the leaves is a very important industry in the Southern States, particularly Victoria and South-Eastern New South Wales. The industry has never assumed very large proportions in Queensland, probably due to the fact that the principal use of the oils is in pharmacy, and the cineol or eucalyptol content of the oils of our commoner species does not come up to the standards required by the British and United States Pharmacopœias, which set the standards at 55 per cent. and 70 per cent., respectively. This is very arbitrary, as it is not at all certain that cineol is the most important germicidal constituent in eucalyptus oils.

An important direction in which eucalyptus oils are employed is in perfumery for scenting soaps, barbers' requisites, &c. The most important species in this connection are those with a strong citron or lemon-scented oil, of which *Eucalyptus citriodora* (*E. maculata* var. *citriodora*) is the most important commercially. It is a remarkable fact that most of the Eucalypts and allied plants yielding citron or lemon-scented oils that occur in Australia are found in Queensland—for instance, Citron-scented Spotted Gum (*E. maculata* var. *citriodora*), the Lemon-scented Ironbark (*E. Staigeriana*), the Citron-scented Tea-trees (*Leptospermum citratum* and *L. Liversidgei*), and the Backhousia (*Backhousia citriodora*).

The name "gum-tree," as applied to Eucalypts generally originated from the amount of dark, gumlike matter that exudes from the tree or is found in cracks in the timber. On exposure to the air it becomes dry and brittle. Such plant juices are known technically as kinos. They are generally impregnated with dark colouring matters, and are used in medicine and in the dyeing and tanning industries.

Though the Eucalypts in themselves form a very natural genus of plants, many difficulties are presented in any attempt to arrange the species into natural groups possessing a number of characteristics in common. There have been various schemes of classification proposed by different botanists from time to time, each scheme being based primarily on one particular feature, such as barks, anthers, fruits, chemical constituents, &c. It necessarily means, however, that such schemes of classification are to a very large extent artificial, trees naturally closely allied being placed wide apart in the arrangement of the genus. The scheme of classification adopted by most botanists and followed by W. F. Blakely in his "Key to the Eucalypts" is based on anther characters, and was originally propounded by Bentham in the "Flora Australiensis." This is a system that, personally, I have found rather difficult to follow.

For field work, as far as Queensland species are concerned, the bark characters are the most serviceable upon which to group the species. Classification of the genus on the bark was first proposed by Baron von Mueller and later elaborated by J. H. Maiden.

The Queensland species can be divided up into five groups—(1) Smooth-barked Trees or Gums proper, (2) Boxes, (3) Stringybarks, (4) Ironbarks, (5) Bloodwoods. To these we can add a further group—the Mallees and Marlocks—based on habit, and not on bark characters.

In the first group (the Smooth-bark Trees or Gums) the trunk is normally smooth, the bark coming off in scales or strips, leaving a clean, smooth barrel; the bark is commonly persistent at the base of the trunk. In this group are included the various Blue Gums, Grey Gums, Red Gums, White Gums, &c. Among the representative species are the Queensland Blue Gum or Forest Red Gum (New South Wales) (*E. tereticornis*), Flooded Gums (*E. saligna* and *E. grandis*), Grey Gums (*E. propinqua* and *E. punctata*). Scribbly Gum (*E. micrantha*), the River Red Gum (*E. rostrata*), &c.

The second group (Boxes) are characterised by having a dark-grey bark, more or less fibrous and much interlocked. The common and most widely distributed group of this species in Queensland is the Bimbil Box (*E. populifolia*). Another species very common is Gum-topped Box (*E. hemiphloia*), characterised by having typical box bark on the trunk, branches and branchlets smooth, and the shed bark often hanging down in long ribbons from the forks. The various bark groups run into one another—*e.g.*, it is hard to know whether the Yellow Box of the Darling Downs (*E. melliodora*) should be placed in the Boxes or Gums proper.

The third group (Stringybarks) possess a very fibrous bark, ageing to grey and often more or less blackened by fire. Representative species are Red Stringybark (*E. resinifera*), Yellow Stringybark (*E. acmenioides*), with its variety *carnea* and allied species *E. umbra*, White Stringybark (*E. eugenioides*), &c. This is an ill-defined group, and includes the Tallowwood (*E. microcorys*), the Rough Stringybark (*E. Baileyana*), and some others with not particularly fibrous barks.

The fourth group (Ironbarks) are trees with a hard, furrowed, black or dark-grey, persistent bark, rather friable, and the cracks often carrying a dark-red kino or "gum." Representative species are Silver-leaved Ironbark (*E. melanophloia*), Broad-leaved Ironbark (*E. siderophloia*), Grey Ironbark (*E. paniculata*), Narrow-leaved Ironbark (*E. crebra*), and Red Ironbark or Mugga (*E. sideroxylon*).

The fifth group (Bloodwoods) possesses a persistent bark, commonly inclined to be spongy and friable, and roughly and irregularly tesselated; outer layers lemellar, inner layers rather fibrous. This group includes the common Red Bloodwood (*E. corymbosa*), Western Bloodwood (*E. terminalis*), the White Bloodwood (*E. trachyphloia*), the Northern Bloodwood (*E. dichromophloia*), and a number of trees known in Western and Northern Queensland as Yellow Jackets (*E. Bloxsomei, E. peltata,* and others).

The sixth group, comprising the Marlocks and Mallees, is very poorly represented in Queensland, but is well developed in the Southern States and Western Australia. Mallees are of a shrubby growth and typically have a large, woody stock from which arises a number of stems all about the same height and thickness. They are frequently gregarious, and occur in the form of Mallee scrubs. Much Mallee scrub has been cleared for farming purposes, particularly wheatgrowing, in Victoria. Marlocks are not represented in Queensland, but are fairly common in Western Australia, and are distinguished from Mallees in

having a much reduced woody stock and only a single stem. They are common on the sand plain country of Western Australia, but it is difficult sometimes to distinguish between the two groups.

Several other genera of Myrtaceæ, though unimportant as timber trees compared with *Eucalyptus,* are very common in the open forests, and some in the rain-forests or jungles of the State.

Angophora is closely allied to Eucalyptus, differing principally in the presence of petals in the flower. The two commonest and most widely spread are those trees known as Apple Trees (*A. subvelutina* and *A. intermedia*).

Tristania is also allied to Eucalyptus, but the leaves are mostly broader and horizontally placed. It is distinguished principally from both *Angophora* and *Eucalyptus* in the stamens, which are united into five bundles. Important species are the Swamp Mahogany (*T. suaveolens*) and Brush Box (*T. conferta*).

Syncarpia is characterised by the flowers being in heads. Three species occur in Queensland. The commonest and best known is *S. laurifolia,* the common Turpentine, which extends from a little south of Sydney, in New South Wales, to some distance north of Cairns, North Queensland.

Xanthostemon is a genus of few species scattered throughout the Malay Archipelago, New Guinea, and Australia. Several are found in Queensland, and most of them are known as Penda. The most important is *X. pubescens,* the Red Penda or Atherton Penda, used for house-framing and flooring under cover. Exposed to the weather its life is comparatively short, varying from five to ten years. The characteristic feature of the genus botanically is the presence of a half-superior or almost wholly superior ovary—an unusual condition in *Myrtaceæ.*

Melaleuca is a widely spread genus in the Malayan Archipelago, Australia, and New Caledonia, but finding by far its greatest development in Australia. Species of *Melaleuca* are usually called Tea-trees in Queensland, though in the Southern and Western States the vernacular is also applied to several trees and shrubs of allied genera. The name Tea-tree is due to the fact that Dr. Anderson, who was the surgeon and naturalist on Cook's third voyage, mistook a species of *Leptospermum* for a North American plant which was then being used as a substitute for ordinary tea. Cook used the leaves of the Australian plant, and the beverage was found, though only moderately palatable, quite useful for keeping down scurvy. The spelling "Ti" should not be adopted.

Of recent years at least two species of *Melaleuca*—*M. alternifolia* and *M. linarifolia*—have come prominently into notice, due to the high germicidal value of their essential oils.

The fleshy-fruited *Myrtaceæ* are mostly found in the rain-forests and along creeks and rivers. The largest genus is *Eugenia,* which includes the common Lillipilli (*E. Smithii*) and the Creek Cherry (*E. paniculata*). Several of the *Eugenias* attain the size of very large trees, and are known as Water Gums. One of these (*E. gustavoides*) is one of the principal building timbers of the Atherton Tableland. The name "Water Gum" is one rather loosely used in Queensland for a number of Myrtaceous trees, being applied to species of *Tristania* and *Agonis.*

A fruit of an evil reputation in North Queensland is the Finger Cherry (*Rhodomyrtus macrocarpa*), reputed to have caused blindness on occasions to persons who have eaten freely of them. At other times fruits seem to have been eaten without any ill-effects following.

Of other genera of *Myrtaceæ*, very few are of interest to the farmer and pastoralist. Some contain edible fruits, the principal genus being *Psidium*, which includes the Guavas. The two commonest in cultivation in Queensland are the common Guava (*P. guajava*) and the Cherry Guava (*P. cattleianum*). Both are natives of tropical America. The former has become quite naturalised in many tropical and sub-tropical countries, including much of coastal Queensland.

Allied to the Guavas is the *Feijoa* (*Feijoa Sellowiana*), a native of the Argentine; it grows well in Queensland, but fruits well only in the cooler parts of the State, such as about Toowoomba, &c. On the coast conditions do not seem to suit it, and, though it grows well enough, ripe fruit are rarely set.

The genus *Eugenia*, already referred to, includes some important fruits. The commonest in Queensland is the Brazilian Cherry (*E. uniflora*). Others less frequently seen are the Rose Apple (*E. jambos*) and the Malay Apple (*E. malaccensis*).

FAMILY UMBELLIFERÆ.

A family of herbs, often aromatic, occasionally with a tendency to be slightly woody or shrubby. Leaves alternate, often much cut and divided; the petiole or leaf-stalk usually dilated into a sheathing base. Flowers in simple or compound umbels. Calyx tube adnate to the ovary, the limb forming a rim around the summit, or 5-toothed or quite inconspicuous. Petals 5. Stamens 5. Ovary inferior, 2-celled. Styles 2. Fruit usually separating into two 1-seeded nuts or carpels called mericarps, leaving a persistent central axis—the carpophore (see Plate 170).

The family is a large one widely spread over the world, but finding its greatest development in temperate regions. It includes a number of vegetables and herbs, as the Celery (*Apium graveolens*), Carrot (*Daucus carota*), Parsnip (*Peucedanum sativum*), &c. The Fennel (*Fœniculum vulgare*) is a common farm weed in Queensland, particularly on the Darling Downs. The native species are few in number; a couple—*e.g.*, *Apium leptophyllum* and *Daucus brachiatus*—are common farm and pasture weeds. They mostly have very insignificant flowers, an exception being the genus *Actinotus* (which includes the Flannel Flower (*A. Helianthi*)) and its allies; their showy character is due to an involucre of woolly bracts (see Plate 155).

[TO BE CONCLUDED.]

Cheese Starters.

E. B. RICE, Dairy Research Laboratory.

THE need for vigorous starters for the manufacture of cheese is now appreciated by all cheesemakers, but there is a lack of knowledge of the scientific principles pertaining to their propagation and functions. It is hoped that this paper will serve to enlighten cheesemakers upon some of the more important aspects of the problem.

Definition.

A cheese starter is a culture of living micro-organisms which is used for the purpose of bringing about certain changes during the manufacture or ripening of the cheese. Different species of micro-organisms are used for different purposes in the manufacture of the many varieties of cheese; such as moulds for the blue-veined cheeses, propionic acid bacteria for ensuring eye-formation in Gruyere cheese, and for the purpose of cheddar cheese manufacture, which is almost the only variety produced in quantity in Queensland, lactic acid bacteria are propagated in milk and added to the milk in the vat.

Classification of Starters.

Starters may be broadly grouped as follows:—

1. Natural.
2. Commercial.

Natural Starters.—The usual procedure followed in the preparation of a natural starter is to choose the milk from some dairyman who is known to take special care in its production and allow the selected milk to sour spontaneously. Starters prepared in this manner have been discarded in most of the leading dairying countries, as their use can only be attended with results that are uncertain. The preparation of starter cultures is now confined to laboratories which specialise in the work.

Commercial Starters.—These are supplied in powder or liquid form, or on what is known as an agar slant. Directions are usually furnished by the laboratory from which they are obtained as to the manner in which large numbers of actively growing organisms are to be built up from the culture. Such instructions should be strictly adhered to. Milk is the usual medium for the propagation of the starter in a factory. Too much emphasis cannot be stressed upon the necessity for using only the best quality milk and observing the utmost care and cleanliness in all operations connected with starter making.

It was the custom formerly to include other bacteria besides the lactic acid bacteria in the starters for cheddar cheese, and these bacteria are still included in the starters supplied by some commercial laboratories. Experience has, however, indicated that although these associated bacteria are desirable in starters for butter manufacture (starter-ripened butter is seldom made in Queensland owing to its inferior keeping quality), their presence is not required in a cheese culture. The particular species of bacterium contained in the starters which are now being supplied by the Dairy Research Laboratory is known as *Streptococcus cremoris,* strains of which are used in starters produced by all the leading dairying institutes. The strain propagated in this laboratory possesses a strong proteolytic power which is considered to

have an important bearing on the ripening of the cheese. The organisms are cultured daily in the laboratory in sterilised skim milk and are transferred to a bottle of sterilised milk prior to dispatch to a factory. This procedure ensures that the starter is in a vigorous condition and enables it to be used immediately for inoculating mother starter in the factory rather than having to subculture for several days before use, as frequently happens with some cultures.

Functions of the Starter.

In the manufacture of cheddar cheese the bacteria are cultivated in the milk with a view to bringing about the development of acid prior and subsequent to the addition of the rennet, as acid production is essential before the further changes in the milk constituents can take place. In factories where pasteuration of the milk is carried out, it is necessary to use a starter to inoculate the pasteurised milk with the desired acid-forming bacteria, and even where milk of comparatively high acidity is received and manufactured without pasteurisation the addition of a small quantity of a good starter is beneficial, as it tends to suppress the undesirable bacteria in the raw milk. When the rennet is added to the milk there must be large numbers of bacteria present, and during the coagulation most of the bacteria are incorporated in the curd. Further growth of these bacteria goes on during the manipulations in the vat and in the early stages of ripening of the green cheese.

The effects of the acidity developed by the starter are fivefold—

(1) To ripen the milk. Ripening the milk favours the coagulation when rennet is added. If the milk were of too low acidity it would curdle slowly with rennet and the manufacturing period would be prolonged.

(2) It favours the expulsion of the whey. The bacteria which are trapped in the curd cause acidity to develop, the curd shrinks and the whey is expelled.

(3) It favours the fusing of the curd particles (matting). This gives a mellow body and texture to the cheese.

(4) It has a protective action against putrefaction. The putrefactive bacteria, being susceptible to acidity, will be restrained in the acid medium, but would quickly spoil the cheese if acid were not present to check their activities.

(5) It favours the action of the pepsin present in the rennet extract. Rennet extract not only has a curdling action due to the enzyme rennin, but also a digestive effect in the presence of acid owing to another enzyme known as pepsin. The pepsin commences to break down the indigestible curd in the vat and continues its action in the ripening room until there is produced a nutritious matured article.

Vitality of Starters.

A most important property which must be possessed by a good starter organism is the ability to produce acidity steadily throughout the making operations. Often a starter will commence to develop acid when it is first introduced into the vat, but fails to maintain its virility when the "cooking" and cheddaring stages are reached. During the "cooking" the temperature of the milk is raised to 100°F., and in extreme cases to 104°F., temperatures which are higher than the optimum for

growth of the lactic acid bateeria used in the starter, while in cheddaring the curd is comparatively dry, which is unfavourable for the best development of the bacteria. Unless the vitality of the starter is good there is the possibility of its becoming devitalised in these operations and causing much annoyance through failure to continue regularly to increase the acidity.

Loss of vitality by starters has received much study in recent years. Singleton states that getting starters constantly over-ripe is a means of decreasing their vigour ([1]). Several workers have referred to the action of certain bacteria in the milk retarding the growth of the starter bacteria ([3]), ([10]). The milk itself has also been blamed for possessing some obscure abnormality, but in most factories plenty of milk can usually be found which will make good starter ([2]). Milk from sick animals should, of course, never be used ([3]). Mammitis milk is a frequent source of trouble in the preparation of starters ([2]).

A test for the vitality of starters which was developed in New Zealand is applied constantly to the starter organisms kept in this laboratory and gives a good indication of how the starter will behave in the cheese vat ([4]).

Failure of Starters.

The sudden failure of a starter or the slow development of acidity, which prolongs the period of manufacture, are two common problems which confront the cheesemaker, and are often traced to the following causes:—

(1) *Mammitis Milk.*—Milk from animals suffering from disorders of the udder is commonly responsible for slow development of acidity in the vat. Recently the services of this laboratory were sought by a factory which has had trouble for months. Microscopical examination of the milk from each individual supplier indicated that no less than five suppliers were sending in mammitis milk. With the rejection of the milk from affected beasts the batch worked normally on the following day.

(2) *Non-acid Milk.*—Certain organisms produce an inhibitory substance which retards the growth of the added starter bacteria ([5]), ([6]), ([7]). Managers who suspect this, or mammitis milk, to be the reason for starter failures are advised to communicate with the Cheese Instructor or the Dairy Bacteriologist now stationed at the Toowoomba branch laboratory, who will endeavour to visit the factory, examine the milk received to detect the supply which is causing the trouble, and give instructions to the farmer concerned.

(3) Recent work at the New Zealand Dairy Research Institute has shown that a phenomenon known as bacteriophage is probably a most important factor in the sudden failure of starters. The bacteriophage may be described simply as a destructive parasite of bacteria. Up to the present no sure method of preventing the destruction of starters by the action of the phage has been found. The indications are that the bacteriophage originates in the cultures themselves and that its development is conditioned by an unknown factor in certain milk supplies ([11]), ([12]).

Purity of Starter.—Factory managers desirous of knowing the state of purity of their starter could arrange also for a sterilised bottle to be sent to them in which to return a sample of the starter for bacteriological examination.

Contamination of Starters.

A badly contaminated starter may often be quite active in the vat and show no abnormality in flavour or aroma. The activity may even be due to the contaminating organisms which, by their action on the milk, render it a more favourable nutriment for the starter bacteria. However, the undesirable effects of using a contaminated starter, although not apparent in the vat, become evident in the matured cheese and cause it to be placed in an inferior grade. The following quotation expresses aptly the risk involved in the use of a bad starter:—"A contaminated starter which goes well in the vats gives a false sense of security, for although the green cheese may appear satisfactory, no one can say what off-flavours may develop with maturity. On the other hand, a pure starter which loses its vitality gives rise to abnormal conditions in the vat for a day or two, but the cheesemaker cannot fail to realise the trouble and take immediate steps to rectify it. However, some factory managers who take special care to avoid contaminating their starters experience more than their share of trouble. This is partly because a pure culture is more sensitive than a contaminated one to slight changes of conditions, and so will more readily 'go off.' Such changes of conditions are chiefly three—(*a*) Changes in the milk; (*b*) inoculation with varying amounts of starter; (*c*) variations in temperature of starter milk—in cold weather sufficient acidity may not develop, while in hot weather the reverse may happen" ([2]).

Examination of starters at factories frequently shows them to be contaminated with yeasts and moulds, which grow quite well in an acid medium, and so the contamination becomes progressively worse as times goes on.

Many bacteria which enter the starter will die out on account of the inhibitive effect of the acid medium, but it is possible to reinfect the starter from day to day by some mistake, such as dipping some of the starter out of the bulk starter with an unsterilised spoon or other utensil, or inserting in it an unsterilised thermometer or stirrer. Some managers place the starter can in the cheese ripening room, because of the more even temperature to be secured there, but this practice is to be condemned because mould spores, which are universally present in these rooms, are sure to contaminate the starter; as has been mentioned, these organisms grow in the acid medium and are detrimental to the quality of the matured cheese. The cheesemaking room is also an unsuitable place in which to allow starter to ripen on account of the high temperatures and the risk of contamination from splashes of water and other sources.

Preparation and Care of Starters.

The length of time that a starter can be kept in a factory without obtaining a fresh culture from a laboratory will depend upon the care which is given to its preparation and the method by which it is carried on from day to day. Some factories have a standing order to be supplied with a new starter fortnightly, some monthly, and some three-monthly, while other factories only procure a fresh culture when that in use shows obvious signs of deterioration. In New South Wales, where the method of carrying starters in the factories closely resembles bacteriological technique, some factories have kept a starter in an uncontaminated condition for years ([8]).

The cultures are sent out from this laboratory in sterilised milk in 4-oz. medicine bottles. Immediately upon receipt of the package half a teaspoonful of culture should be inoculated into about a pint of pasteurised milk in a bottle, thermos flask, or other suitable container, the milk being pasteurised in the container, so that the most favourable conditions possible are provided for the starter organisms. The distance of most factories from Brisbane is over 100 miles, transport is rather slow, and temperatures in the warmer weather are relatively high; hence the culture will generally have coagulated by the time it reaches the factory. When the milk coagulates there is no further growth of the lactic acid bacteria and they gradually die out, so the first inoculation from a newly acquired laboratory culture should be rather heavy because its vigour has diminished, but after several propagations an active starter should be secured.

Milk for Starters.

Only the best quality milk should be used for the cultivation of starter bacteria. Mixed milk from a herd is preferable to that from a single cow, because certain cows give milk which hinders the growth of starter bacteria. Knudsen, one of the foremost authorities on the subject, also states that milk for starters should be rich in total solids [3]. Managers can check the total solids of their milk by indirect estimation from the lactometer reading and percentage of fat, according to the following formula:—

Total solids = $\frac{1}{4}$ Quevenne lactometer reading x 1·2 fat plus 0·14. The milk should also be of high initial acidity, as mammitis milk frequently is of low acidity. It is important to make the acidity test soon after the milk is produced in order to avoid the risk of slight souring creating a false impression.

Preparation of Mother Starter.

Much better results would be achieved in many factories by keeping a mother starter. It is well understood that cheesemakers are fully occupied by their duties, but the extra time required to do this work would be quite inconsiderable and it would assist to prevent the carrying over of a fault which may develop in the bulk starter on any day. In this connection I quote from a letter received from one manager—"We are getting much more satisfactory results than last season, and any trouble in the bulk starter now occurs for one day instead of being carried forward every day." Utensils which are used to hold the mother starter include glass jars, thermos flasks, and so on. They should be of about 1½ to 2 pints capacity, and about 1 pint of milk should be added to them, so as to leave ample space above the surface of the milk in the event of splashing taking place during pasteurisation.

One method of pasteurising is to place the vessel containing the milk in a saucepan, add water to the saucepan till the surface of the water is level with that of the milk—then heat until the water boils and hold at this temperature for twenty minutes. The milk is cooled to about 70° Fahr. before the culture is added, the cooling being allowed to take place slowly if the vessel is of glass in order to save it from cracking. A few drops of starter only are needed to inoculate the milk—0·5 cc. should be ample. A good way to do this is to use a narrow hollow glass tube or a straight-sided 2 cc. pipette, which has been sterilised in boiling water or steam, for transferring from the coagulated culture into the pasteurised milk.

A much better method of preparing mother starter and which eliminates much of the risk of contamination is to pasteurise the milk in a steamer. An account of the method used at Gatton College has been given to me by Mr. R. R. Keats, Dairy Instructor at the College, and is as follows (9) :—

A steam steriliser was made at the College for use in connection with the propagation of pure cultures and mother starter. The materials used in its construction were an 8-gallon petrol drum, some plain galvanised iron, rivets, some ½-inch piping, and three ½-inch back nuts. The design is simple, and for those who wish to construct the steriliser the following details are given:—

First cut the top from the petrol drum. Two holes are then cut in the bottom sufficiently large to admit ½-inch steam piping (approximately ¾-inch diameter), one in the centre and the other nearer the side. Over the latter hole on the bottom of the drum is sweated one of the back nuts into which is fitted a short piece of piping. Another piece of piping 2½ inches long with a thread 1¼ inches long and fitted with one back nut is passed through the centre hole, thread first, and the other back nut screwed on the outside to make secure. Eight right-angle supports are made from ¾-inch wide strips of iron cut from the top of the can, four of these being riveted to the inside of the can, at equal distance apart and 3 inches from the bottom, the other four being similarly fixed 11½ inches from the bottom. A disc of galvanised iron 11½ inches in diameter is cut and perforated with a number of ½-inch diameter holes. To the centre of the bottom of this disc or platform

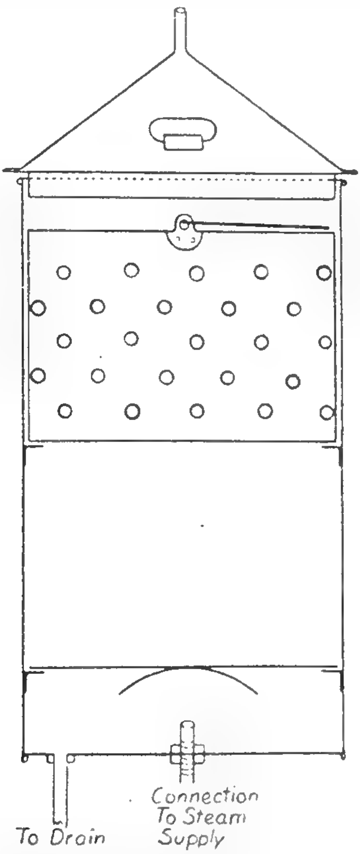

Plate 10.
Steam Steriliser, Q.A.H.S. & C. Scale, ⅛ inch to 1 inch.

is riveted a steam baffle plate made from the top of the drum 5 inches diameter and made saucer-shaped. The top container consists of a bucket, made from galvanised iron, perforated with ½-inch diameter holes on the sides and bottom and provided with a handle for removing it from the steriliser. Its measurements are 11½ inches diameter and 8 inches deep. The lid, made from galvanised iron, is conical in shape, fitted with a ½-inch pipe at the top for the escape of steam, also two wire handles. The steriliser is mounted on an iron bracket attached to the wall and is connected with the steam supply, to the fitting at the centre of the bottom of the drum. (*See* Plate 10.)

Operation.—Glass jars, or test tubes of milk, flasks, &c., are placed in the steriliser, either on the bottom platform or in the top container and the lid placed in position. The draining valve at the bottom is opened slightly and any condensed steam water allowed to drain off, including any from the steam inlet pipe which is also opened slightly. The correct amount of opening may then be given to the steam inlet valve and steam admitted to the chamber. The escaping steam should just be blowing slightly from the escape pipe in the lid when properly adjusted. Before removing the lid from the sterliser turn off the steam supply and allow if possible fifteen to twenty minutes to elapse before opening, to avoid cracking of glassware due to a possible sudden drop in temperature. Keep the draining valve slightly open during sterilisation.

After the addition of the drops of culture to the milk, mix by gentle shaking, and incubate at 70° Fahr. It is important to maintain a uniform temperature during incubation. The milk should be coagulated in from eighteen to twenty hours, and the coagulated mother starter is used for inoculating the larger quantity of pasteurised milk to be used for the bulk starter on the following day. By careful daily observation of temperature, number of drops of culture added, and the time taken to coagulate, the cheesemaker can regulate conditions so that the mother starter is just firm by the time it is ready to use for making bulk starter.

Avoid Enamelled Billycans.

The use of enamelled billycans to hold mother starter, although very common, is considered unwise, because of the ease with which the enamel becomes chipped or scratched, leaving crevices which will harbour undesirable types of bacteria unless rigorous sterilisation is carried out.

Preparation of Bulk Starter.

With the large quantity of milk required for this purpose, heating and cooling are preferably done in a vessel through which steam and water from the factory supply can be circulated. The quantity of milk which will be needed will vary according to the volume of milk treated at the factory. Place the calculated amount of milk in the starter can, which should be fitted with a metal lid, fill the outer vessel with water, and raise the temperature of the milk to 180° Fahr. by injecting steam into the water through the steam inlet valve, keep at this temperature for one hour longer, and then cool to 70° Fahr. by shutting off the steam, opening the water inlet valve and passing cold water through until the desired temperature is attained. Now inoculate with the mother starter, which should be just firmly coagulated. The usual quantity found necessary is about three-quarters of a fluid ounce per gallon of milk. On the following morning when this milk has coagulated it will be ready to add to the cheese vat.

As with the mother starter, conditions should be regulated to have the bulk starter just firm when ready for use, but should it be necessary to hold it for some time, it should be placed in cold water at 50° Fahr. to prevent the attenuation of the bacteria which takes place after coagulation of the milk.

Mr. Keats has given me the following description of the method of pasteurising milk for the bulk starter at Gatton College:—

"To pasteurise milk for the making of bulk starter, a special vat and can is used, in which the milk is both heated and cooled. For college purposes a 5-gallon can is sufficient, but, of course, a larger outfit may be constructed on similar lines if desired. The can is made from stainless steel, has a rounded base and no seams, all joins having been electric welded. It is provided with a conical-shaped lid. The heating vat is constructed of heavy-gauge galvanised iron, has an overflow pipe near the top, and is fitted with a perforated pipe at the bottom which is connected outside to the steam and water supply.

"*Operation.*—The can containing the milk is placed in the vat, and the supply of water turned on until it flows through the overflow pipe. The water supply is now turned off and steam admitted to heat the water and thus heat the milk. A temperature of 180 to 185° Fahr. is held in the milk for a period of one hour, the steam supply being regulated to obtain this result. The water supply tap is now opened and cold water allowed to flow into the vat slowly until the milk is cooled.

"Although the heating vat, which was made by the college plumber, has been replaced three times owing to leaks caused by rust formation, the starter can which has been in use for eight years has retained its new appearance owing to the quality of the stainless steel used in its construction, even though abrasives, such as steel wool, are frequently

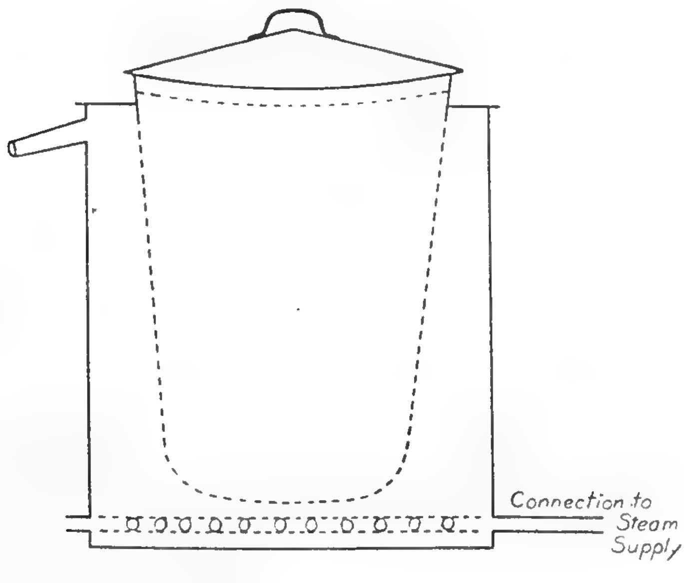

Plate 11.
Starter Milk Pasteuriser, Q.A.H.S. & C. Scale, ⅛ inch to 1 inch.

used to remove the film of casein which forms on the inside of the can. Usually, heavily enamelled buckets or billycans are used to 'set' the starter, but on frequent occasions the steel can has been used, with no apparent detrimental effect on the quality of the starter." (*See* Plate 11.)

Adding the Starter to the Vat.

For the manufacture of cheddar cheese from pasteurised milk about 1 to 1¼ per cent. of starter needs to be added to the vat. The quantity of starter to use for unpasteurised milk will, of course, depend upon the acidity of the milk. When unpasteurised milk is used for cheesemaking, the addition of some starter, by introducing large numbers of lactic acid bacteria of vigorous type, will assist to overcome undesirable fermentations, thereby improving the flavour and texture of the cheese. Care should be taken not to add too much starter; it is far better to add the quantity just stated, and if trial shows this to be insufficient, a little more can be used, but the addition of too much starter should be avoided. The starter should always be strained through cheesecloth as it is being added to the vat to ensure that lumpy particles do not get into the vat.

Examination of Starter.

The characteristics of a good starter are—

(1) A clean, acid flavour. The acid produced by *Streptococcus cremoris* alone may seem somewhat sharp to anyone unaccustomed to it, because of the absence of the associative organisms which give a milder flavour and fuller aroma to starters in which they are grown in association with *Streptococcus cremoris.*

(2) The coagulation should be smooth, free from whey and gas pockets. As the strain of *Streptococcus cremoris* propagated in this laboratory has strong proteolytic power it may digest the curd with extrusion of some whey and also produce a slight quantity of gas, if left standing after coagulation.

(3) If broken up it should be of a smooth, creamy texture, entirely free from curdiness.

(4) The acidity at the time of use should be between 0·65 and 0·75 per cent., and should not exceed 0·85 per cent.

Defects in Starters.

Malty Flavour.—A malty flavour sometimes is noticeable in starters, and will be conveyed to the cheese. It is due to a variety of *Streptococcus lactis,* which appears to gain the ascendancy at times. The defect cannot be remedied in the factory and the only course is to discard the starter.

Ropy Starter.—A ropy or slimy condition may suddenly appear in a starter and it may just as suddenly disappear. If it persists it will increase in intensity and the starter will have to be replaced. The condition appears to be associated with the absorption of oxygen from the air during the cooling of the milk after pasteurisation, as heating and cooling the milk in a narrow-necked vessel will overcome the fault. Continual inoculation from the surface of the starter will also induce this defect.

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CEREAL SEED TREATMENT.

Bunt and flag smut of wheat are two diseases which in the past have caused serious loss to wheatgrowers. In recent years the percentage of the total crop of this State, which has been affected adversely by these diseases is, fortunately, quite low. However, there occur instances of heavy individual loss, usually attributable to neglect of seed treatment. Seed from a source known to be free from flag smut and bunt (also known as ball smut) needs no treatment. All other wheat seed should be given a protective coat of fungicidal dust. The dust used most widely is copper carbonate, and this is quite effective in dealing with lightly contaminated seed. Seed which carries so many spores that it is noticeably dark should not be used, although it can, if necessary, be freed from infection by the old-fashioned wet treatment with bluestone. A recent development in seed treatment is the use of mercury dusts to replace the copper. The mercury dusts are somewhat more effective, and have superior physical properties; that is to say, they adhere to the seed better and do not fly in the air and do not tend to clog the drill, as does the copper carbonate. The copper dust, on the other hand, is less poisonous to animals and is cheaper. With reasonable care in keeping seed wheat separate from that used for feed, the poisonous nature of a dust should not be attended by any untoward results, and the cost of even the more expensive material amounts to only a few pence per acre. The mercury dust at present being marketed in Queensland is one of the most effective, and is known as Ceresan.

In the case of barley and oats serious difficulty has been encountered in this State in recent years in growing clean crops on account of the high percentage of smut present. This has been due largely to the fact that bluestone and copper carbonate fail to control these diseases. One of the older wet treatments —namely, that with formalin—is effective if applied correctly. Recent experiments have shown that a dust treatment is available for barley and oats. Ceresan and certain other mercury dusts will control the smuts of these two crops. Either the formalin wet treatment or the mercury dust dry treatment is also effective in the control of the covered smut of prairie grass. When Ceresan is used in the control of any of the above diseases it should be applied to the seed at the rate of 2 oz. per bushel.

New Highways in Queensland.

[*Continued from page 829, December, 1936.*]

Plate 12.
A curve in the new road through the rich jungle lands of Palmerston, connecting Millaa Millaa with Innisfail.

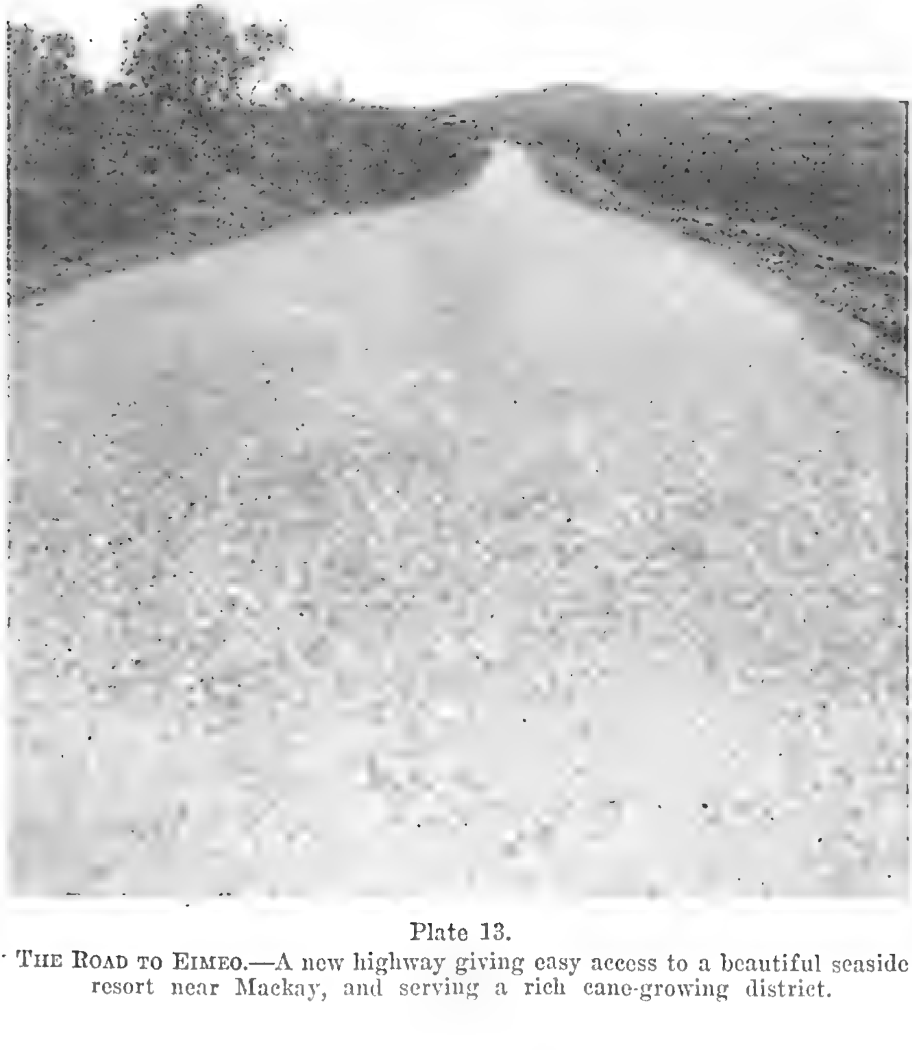


Plate 13.
THE ROAD TO EIMEO.—A new highway giving easy access to a beautiful seaside resort near Mackay, and serving a rich cane-growing district.

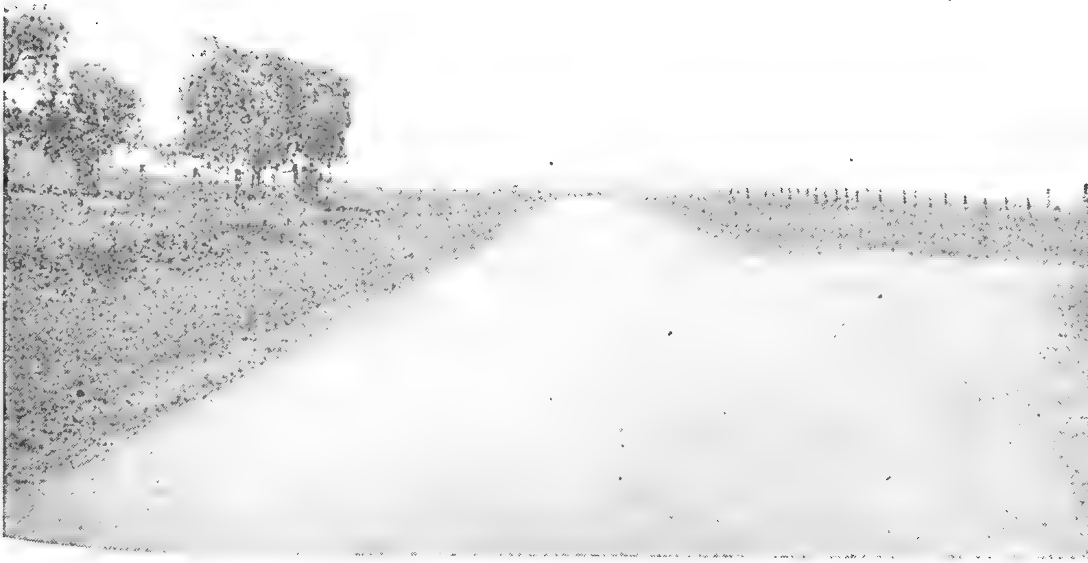


Plate 14.
A bitumen-paved section of the Toowoomba-Warwick Road, Darling Downs.

Plate 15.
Through the rich grasslands of the Dawson River country. The road connecting Theodore with the Cracow Gold Mines.

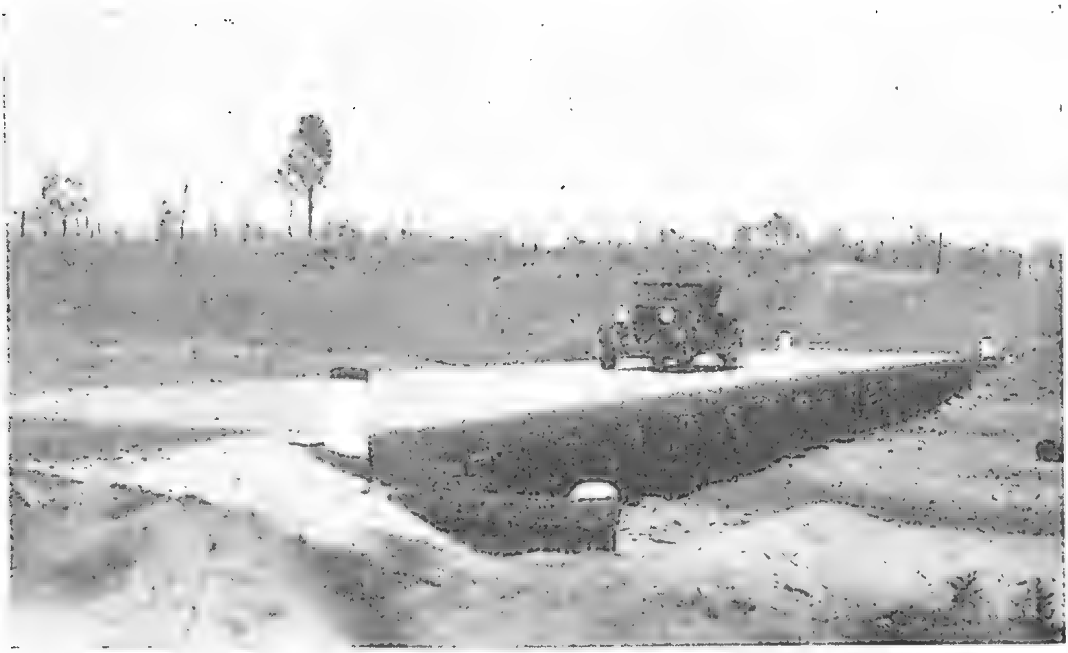


Plate 16.
This multiple span log drain topped culvert over Reedy Creek, in the Kingaroy District, has replaced an old sandy crossing.

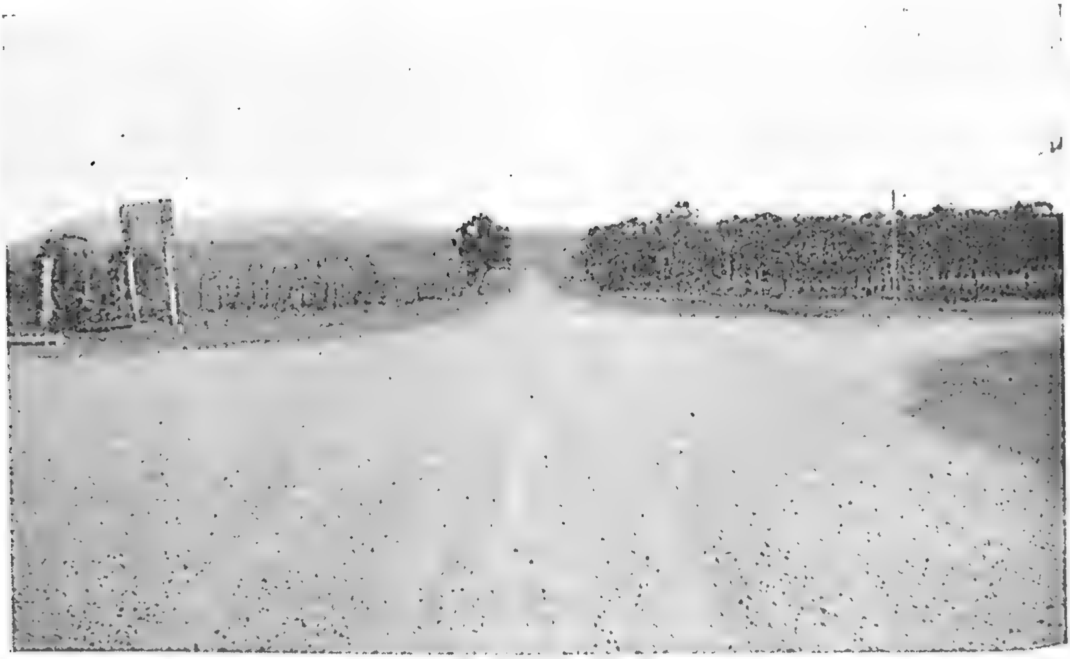


Plate 17.
This bitumen-sprayed paved roadway leads from the Lockyer to the Southern Darling Downs.

Plate 18.
Calen-Kungurri Road—Pioneer Shire—under construction. This will provide a link with canegrowing areas west of the main railway line.

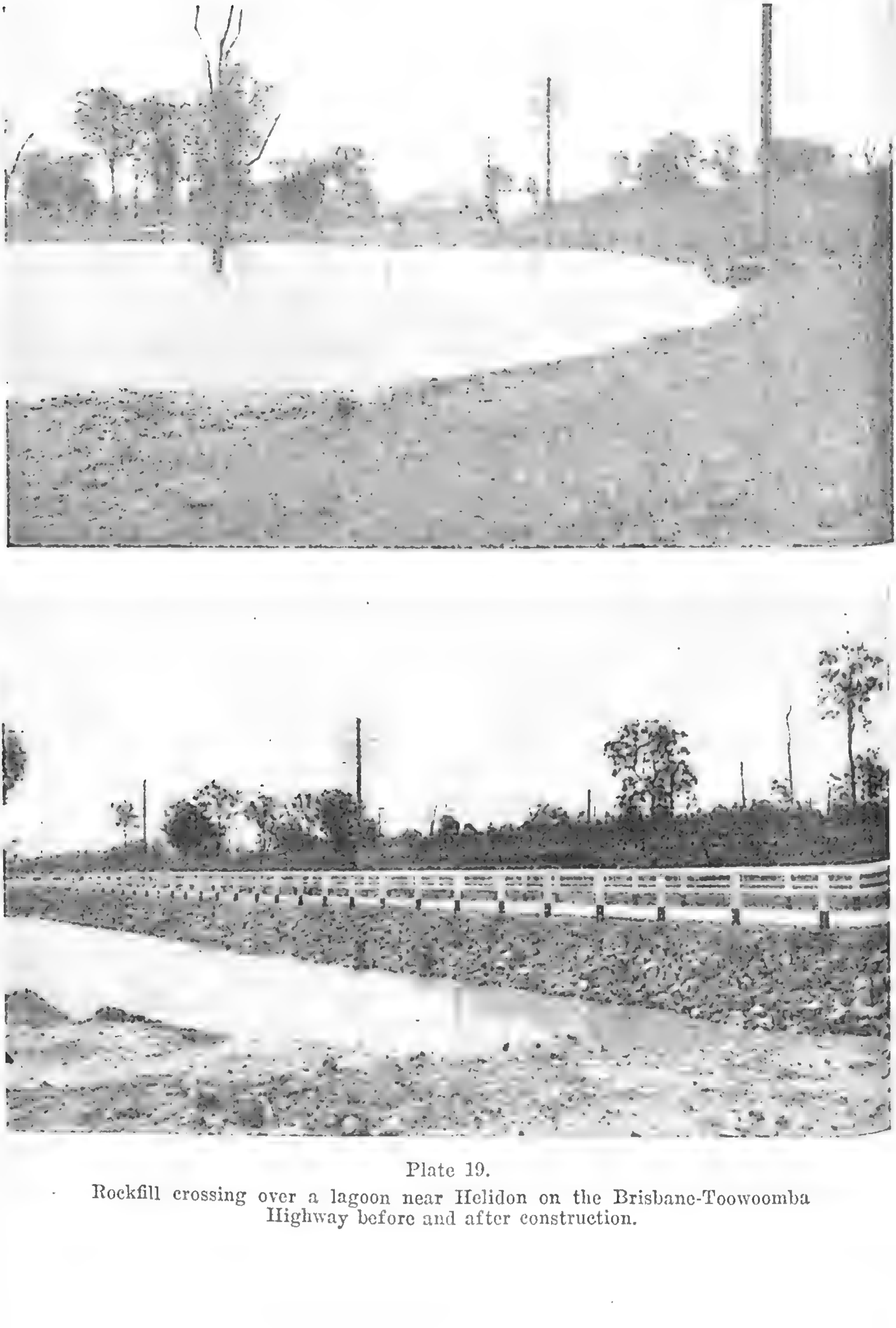


Plate 19.
Rockfill crossing over a lagoon near Helidon on the Brisbane-Toowoomba Highway before and after construction.

Plate 20.
Townsville-Moongobulla section of the Mount Spec Road, North Queensland.

Plate 21.
The first of the foothills come into sight on the road to Mount Spec.

DECEMBER weather was unsettled throughout, with scattered storms and fair relief rains in many districts. The heavier falls were received from 12th December to the 17th December, replenishing water supplies and providing heartening relief over a large area of the Darling Downs and South-West. No steady general rains have been received, however, and many districts are still in urgent need of soaking showers. Pastures have responded rapidly wherever rain has been heavy enough, and many farmers have been able to plant maize and general summer fodder crops.

Wheat.

Seasonal experience indicates the necessity for improved cultural methods if the average yield is to be maintained. Reports show that although the season proved unfavourable, payable crops were harvested in every instance where the land was ploughed early and kept clean until the sowing period.

The spread of black oats is a matter of concern, indicating the desirability of long fallows combined with the growth of purely grazing crops in rotation with wheat.

The entire crop, apart from seed and feed requirements, has been sold to Queensland millers at a satisfactory price, growers having received payments covering the first advance of 3s. 6d. per bushel for Q1 wheat. Although farmers are compensated for lower yields by the rise in world wheat prices, the State as a whole will lose, owing to the necessity of importing approximately 3,000,000 bushels of Southern wheat to supplement local supplies.

Fodder Conservation.

The recurring periods of under-average rainfall, resulting in a serious decline in production, directs attention to the lack of any general provision against prolonged dry periods. Many farmers will, doubtless, adopt a more active policy of conservation in the future, both for use during dry spells and for normal winter and spring supplies, thereby maintaining production at a high level and keeping their stock in good condition throughout the year. An object lesson is provided by the coastal fodder conservation competition conducted by the New South

Wales Department of Agriculture. The fodder conserved is judged on suitability, quality, location, protection, economy, carrying capacity, and surplus. The winner of the North Coast championship, where droughty conditions similar to those obtaining in Southern Queensland have prevailed, had conserved 110 tons of chaffed maize and sorghum silage and 56 tons of lucerne hay. Although no grain was stored the fodder conserved was sufficient to feed ninety-three head of cattle for the stipulated period, notwithstanding the fact that the natural carrying capacity of the 115-acre property was assessed at thirty-one head. The crops cultivated on this farm included 20 acres lucerne, 18 acres maize and sorghum for fodder, 16 acres of oats, and 2 acres of pasture grasses.

Although the practice of fodder conservation has greatly increased during recent years, the total bulk of such fodder is still insignificant compared with the total number of stock carried throughout the coastal areas of New South Wales. In Queensland, practice in this connection lags considerably behind that of the Southern States. In New South Wales approximately 400 concrete tower silos have been erected during recent years, mainly for normal winter feed, the general practice being to store fodder intended as a drought reserve in trench silos which can be excavated cheaply as crops become available.

Tobacco.

The vital stage in tobacco seedling production occurs during the early period of growth, while the plants are small and possess a poorly developed root system. It is essential that abundant water be supplied, and that the beds never be allowed to dry out. The quantity of water required and the frequency of waterings will depend on climatic conditions. Under dry conditions, it may be necessary to water as often as three times a day during the first few weeks. As the plants grow and the root system extends, watering may be reduced to once daily. From the time of germination onwards it is necessary to protect young seedlings from the hot rays of the sun to an extent dependant on local conditions. The type of cover used would be determined by the subsequent precautions to be adopted against disease and insect attack.

Seedlings should always maintain a vigorous growth, and should there appear to be a serious retardation of growth at any time the application of a solution of nitrate of soda in water at the rate of ½ oz. per 4 gallons will, in most instances, sufficiently quicken growth. On the other hand, it is inadvisable to apply nitrogenous manures too liberally, or there would be a tendency to "soft seedlings," which will later be difficult to "harden off."

"Hardening off" should be a gradual rather than a sudden process, and the plants should be allowed an increasing amount of sunlight in the mornings and afternoons, until they can stand full sun during the whole of the day. The tendency of some growers to retard seriously the growth of seedlings is to be deplored. Very often it is found that when the plants reach a stage suitable for planting out weather conditions are such that planting in the field cannot be commenced with any degree of safety. Rather than retard the growth of these plants until planting-out can commence, it is preferable to have another series of slightly younger seedlings which can be utilised and the originals destroyed. The adoption of such a procedure would ensure a quantity of seedlings "hardened off," but at the same time in reasonably vigorous growth. Such seedlings are then able to make a rapid recovery from the shock of transplantation, and to make quick growth in the field.

Cotton.

Planting rains were experienced over many sections of the cotton-growing districts during the month, but owing to the lateness of arrival and the light nature of the rainfall in some sections an appreciable acreage will not be planted to cotton this season. This applies more particularly to the fertile alluvial soils of the older cultivations, where the experiences of past seasons have indicated that late plantings of this crop cannot be relied upon to produce profitable yields, especially in seasons experiencing wet conditions during January and February.

In the districts where the early rainfall allowed the crops to be started off in the normal planting season excellent progress has been made, and the most forward plants are flowering and setting a good load of squares and bolls. The general condition of the crop is, therefore, very mixed, and the nature of the season for the next three months will have a marked effect on the yield obtained. Fortunately, an increased area of the quicker-maturing varieties has been planted this season, which should help overcome the delayed start to a marked extent.

Sugar.

All cane areas from Mackay north received excellent rains during December, so that the crop in those parts is now making rapid progress.

Though relief rains have been received in the Southern districts, they are altogether too light to promote rapid growth, and a good downpour is necessary to assure the 1937 crop.

CROWN LAND FOR GRAZING HOMESTEAD SELECTION.
CUNNAMULLA DISTRICT.

174,931 ACRES OF SHEEP LAND—PART OF THURRULGOONIA RESUMPTION.

This land has been surveyed as portions 5, parish of Cotton, 1 and 2, parish of Magic, and 1 and 2, parish of Kumbogan, and will be open for Grazing Homestead Selection at the Land Office, Cunnamulla, on Monday, 8th March, 1937, at 11 a.m.

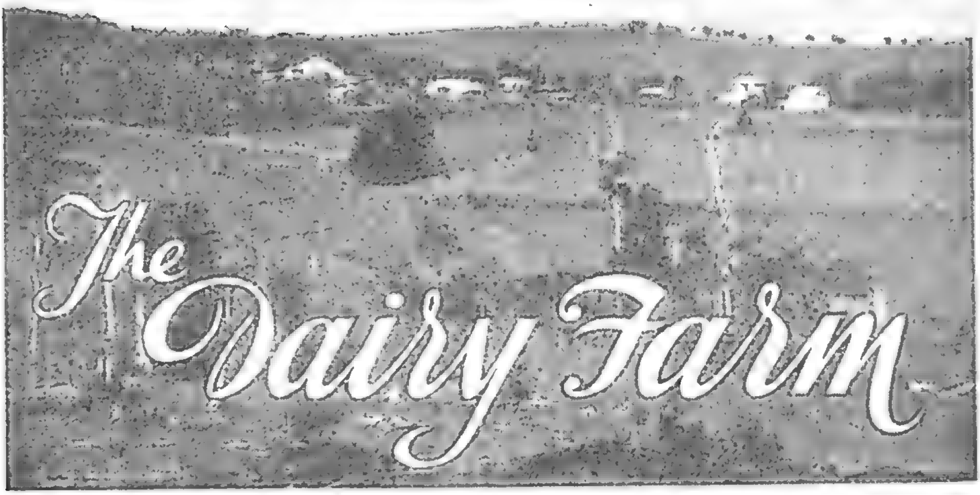
Each selection will be for a term of 28 years.

The annual rentals for the first period of 7 years are from 1d. to 2¾d. per acre.

Each selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of 3 years.

The blocks are all good woolgrowing country and are artificially watered by bore drains, but more water may be required.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane; the Land Agent, Cunnamulla; and the Government Tourist Bureaux, Sydney and Melbourne.



THE INFLUENCE CF FEEDING ON BUTTER-FAT.

F. C. COLEMAN, Inspector of Dairies.

VERY many dairymen hold strong convictions that certain feeds will increase the butter fat percentage of their cows. While it is perfectly true that a change from, say, ordinary grazing to special and extra feeds of balanced rations will result in a larger quantity of butter fat produced, this will have been brought about by an increase in the quantity of milk and not by any increase in the fat percentage. Butter fat percentage is an hereditary factor; a cow is a 4·2 per cent. cow or a 6 per cent. cow, according to her inheritance, and the manner of feeding will not alter the average percentage.

Many experiments have been carried out to determine the possibility of increasing the fat percentage by special feeding, particularly with feeds rich in fats, but the deductions were that if occasionally the fat content has been slightly increased over a very short period the milk quickly returns to its normal composition.

Experience shows that although a cow's butter fat percentage will vary at both milkings during the day, and also from day to day, due largely to uneven periods between milking, yet it is a constant factor taken over a long period.

It can be said that stock which are always well fed and in good condition will maintain their fat percentage at the normal level, as compared with cattle running on overstocked country and which are underfed and in poor condition; and whose tests would, consequently, be lowered. This is due to the fact that cows in poor condition use up some of their body fat to maintain the quantity in their milk, but eventually they become incapable of doing this, and although probably only giving very small quantities of milk, there will be a decrease in the fat percentage.

An increase in the butter fat percentage of the milk of a herd would probably be brought about by the use of bulls from dams noted for their high production tests. It is well known to those who study

the herd books that there are families in each breed noted for their low tests, and also those noted for their high tests, and it is from the high production testing families that a bull could be carefully selected for the object in view.

MAT GRASS A MENACE TO PASPALUM PASTURES.

W. D. FRANCIS, Assistant Botanist.

IN the past five years mat grass or carpet grass has become a serious menace to the better class paspalum pastures of South Queensland dairy farms. In several localities this inferior grass has already established itself in the paspalum pastures with detrimental effects.

There are two different races or varieties of mat grass. One variety has flat, broad leaves, and in general the plant is pressed fairly closely to the ground. The other has narrower leaves, and develops upright shoots which bear leaves and seed heads. The broad-leaved variety is apparently the better variety from the aspect of palatability, as it is eaten much more frequently by stock than is the narrow-leaved kind. The broad-leaved variety is more often found in flats. The narrow-leaved kind is most frequently found on hills. In most instances the narrow-leaved variety is the greater menace to the paspalum pastures. Both varieties develop a slender seed-bearing stalk which carries two or three narrow spikes of very fine seeds.

Matgrass or carpet grass is a native of the Southern United States (North Carolina to Florida, Texas, and Arkansas) and tropical America.

Dairy farmers whose herds are maintained by paspalum pastures should keep a close watch to prevent this deleterious grass from gaining a hold on their pastures. In most districts mat or carpet grass is well known, at least to some of the farmers. In all cases where a strange grass with a vigorous habit has made its appearance investigation should be made. Precautionary measures are especially necessary if the grass is avoided by stock. When local farmers are in doubt, specimens of the suspected grass should be sent direct to the Government Botanist, Botanic Gardens, Brisbane, for advice. In these cases it is always desirable, where possible, to include material which bears seed-heads.

As soon as mat or carpet grass is found to have established itself on a farm immediate and effective measures should be taken to destroy it. For this purpose digging out and burning are recommended. Then a close watch must be maintained for the appearance of the young plants developing from seed in the ground. These fresh plants should be rigorously destroyed before they develop seed-heads, which will continue the menace of this inferior grass.

WHY CREAM TESTS VARY.

E. B. RICE, Assistant to Analyst, Dairy Research Laboratory.

MANY dairy farmers who receive factory returns showing variations in the fat tests of their cream are inclined to wonder why they can occur. Because, apparently, the cream is produced under similar conditions from day to day they cannot understand how there can be any variation in the tests. In reality, variations are bound to occur, and should the returns be always the same it points to something wrong with the testing.

Conditions under which the milk is separated lead to changes in the cream tests, and are chiefly to be accounted for by the following factors:—

1. Speed at which the separator is run.
2. Rate of inflow of milk.
3. Richness of milk.
4. Temperature of the milk.
5. Quantity of skim milk or water used to flush the bowl.
6. Smoothness of running.

To discuss these points in their order:—

1. The separator should always be run at the speed directed by the maker to obtain maximum efficiency. It is better to turn at too high a rate than too slow, for, in the latter case, the fat loss in the skim milk is increased in proportion to the decrease in the number of revolutions below the recommended speed. Turning at too high a speed gives a richer testing cream, but may be injurious to the mechanism of the machine.

2. The level of the milk in the bowl is controlled automatically by the milk float, and it is necessary that the milk be allowed to enter the bowl freely during separation. If the flow be partly shut off a higher testing cream will result, but an over supply to the bowl will lower the test, and, what is more important, excessive fat loss will occur, with a consequent reduction in the farmer's income. Therefore, in order to obtain best results, see that regularity of inflow is maintained.

3. The daily variation in the fat content of the mixed milk from a herd is sometimes appreciable. This affects the test of the cream supplied, but is without influence on the quantity, provided other conditions are similar from day to day. For example, in the cream obtained from 100 lb. of milk with a fat test of 4 per cent. there are 4 lb. of butter fat; while in the cream from 100 lb. of milk obtained from a herd giving milk with an average fat content of 5 per cent. there are 5 lb. of butter fat, although the same quantity of cream is yielded in each case, if all other conditions are identical.

4. As it comes from the cow, milk is at the best temperature to be separated; being near 90 degrees Fahrenheit it is less viscous than at lower temperatures, so runs easily through the separator, and more perfect separation of the fat results. At lower temperatures, due to the viscosity of the milk, separation becomes more difficult, with greater fat losses, and, in fact, it is doubtful if any machine will do good work if the milk is below 80 degrees Fahrenheit.

5. The quantity of skim milk or water used to flush the bowl usually varies considerably from day to day, and may be responsible for a variation in the test of 2 to 5 per cent., depending on the quantity of cream.

6. Vibration causes the skim milk and cream to be shaken together, so that they do not find their way to their respective outlets. Fat losses are increased then by the escape of fat globules through the skim milk outlet.

Other factors which influence the fat losses are the cleaning of the separator and the condition of the milk, but these should not cause any difficulty where a proper appreciation of the need for hygienic methods in the production of such perishable commodities as dairy produce is realised.

MARKETING BANANAS.

J. H. GREGORY, Instructor in Fruit Packing.

WITH the commencement of the deciduous fruit season, banana growers are again faced with the low-price period, and are striving to obtain the best price possible for their fruit. A visit to many plantations reveals practices the ill effects of which are seldom seen or even realised by the grower but which help to render fruit unattractive when the case is opened in the market, and in this way help bring a lower return than might otherwise have been received. The following suggestions are offered with a view to assisting growers to market fruit of an attractive appearance.

During the present hot weather bananas which have been cut and left exposed to the sun for only a short period soon become quite unfit for marketing, and the pulp is eventually reduced to a soft, boiled condition. Cutting should be done in the early morning, before the heat becomes severe, and care should be taken to keep the fruit covered thoroughly, even from the early morning sun, while waiting to be carried or wired to the packing shed.

The fruit should at all times be handled with the greatest care—in fact, the less it is handled the better—and for this reason it is wise to have the packing shed right in the plantation, if possible. On cutting the bunch it should not be laid carelessly at the foot of the stem, which usually means it rests on a bed of sticks and dead weeds. A bed of leaves is easily and quickly formed if the bunch must be set down in the plantation, though a better plan is to carry it straight into the shed or to the end of the wire and there place it in an upright position on bags or trash with the stalk leaning against a rail provided for the purpose. In this manner only a minimum number of fruit will be damaged.

On being dehanded the fruit should be allowed to drain for a few hours. Packing immediately after dehanding sweats the fruit in the case and renders bruising much easier. Care should be exercised to ensure that fruit which is "sprung" or in the early stages of ripening is not packed, as this will quickly be reduced to pulp and be most unsightly in a case of otherwise sound bananas. No fruit should be packed for Southern markets from bunches in which some of the fingers are already showing colour indicating ripening. The fruit should be dehanded just at the collar joining the fingers to the main stalk. The most suitable knife for this work is one of a sharp, flexible, and fairly narrow type.

There is a right and wrong way to separate the hands into singles. Tearing the bananas apart endways often peels part of the skin from the fruit and also bruises the stem, thus setting up an entrance for organisms responsible for black-end. The correct method of separating into singles is to grasp the cluster firmly with both hands at the stem end, then twisting one hand forwards and the other backwards, the fruit is separated easily and without any damage to the stalk end.

On completion of packing the cases should be packed on their sides in a cool, shady position to await transport to rail or market.

MARKETING PASSION FRUIT.

J. H. GREGORY, Instructor in Fruit Packing.

WITH the advent of warmer weather passion fruit growers should exercise greater care in the harvesting of their fruit. Fruit should not be allowed to fall from the vines as fallen fruit quickly becomes crinkled, reducing its size and value to the retailer. By picking the fruit when it is showing half colour its marketing life will be greatly increased, and its selling value raised. Where a grower has a percentage of crinkled fruit, it should be included with marked and blemished fruit and packed separately from the uncrinkled fruit. While most retailers have no outlet for crinkled fruit, there is, however, a good market for fruit of this description.

All fruit should be carefully handled and packed on the diagonal system, which gives the fruit the maximum of protection and display value, thereby greatly enhancing its general appearance.

Citrus Culture in Queensland.

R. L. PREST, Instructor in Fruit Culture.

[*Continued from p.* 812, *December*, 1936.]

PRUNING OF CITRUS TREES.

IN Queensland there is a wide divergence of opinion on the subject of citrus pruning, which is probably due to the influence of individual pruners who have developed certain systems which they believed suited their trees.

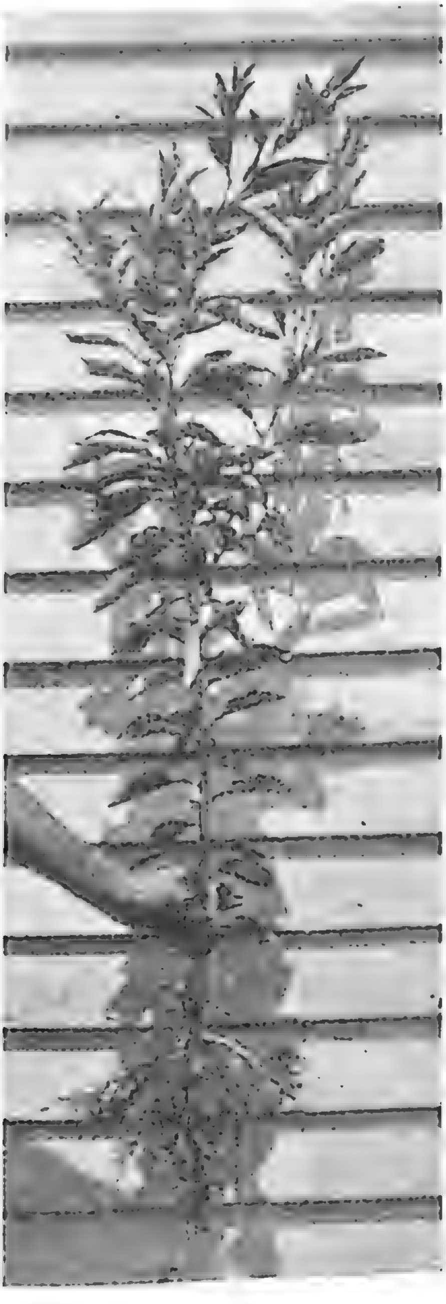


Plate 22.
A desirable type of nursery tree.

Pruning has, as a consequence, generally developed into a mechanical procedure rather than one based on an understanding of principles involved.

In general terms the method of pruning depends on—

(*a*) The age of the tree.

(*b*) The variety of the tree.

(*c*) The type of tree (whether vegetative or fruiting).

(*d*) Soil and cultural conditions.

Plate 23.

The nursery tree shown in Plate 22 prepared for planting.

The main objects in pruning may be classified as follows:—The training of young trees; the removal of undesirable limbs; the modification of form to meet economical and cultural requirements and to counteract unfavourable climatic conditions; the removal of injured and worn out parts; the renewal of old and decadent trees.

PREPARATION OF NURSERY TREES FOR PLANTING.

The present day tendency of nurserymen is towards the practice of sending out trees carrying large heads, and in some instances shaping their prior despatch. The former method is best, as the planter is better able to shape the trees as he desires them. The latter is of little benefit owing to damage which may be sustained to some of the branches during transit.

The rooting system should be well washed prior to planting in order to remove any of the mud puddle which may be adhering thereto. Bruised and broken roots require to be shortened, and the head of the tree should be shortened and shaped to develop evenly.

Plate 24.

A newly-planted tree. Note that the union of the stock and scion is well above ground level.

TRAINING YOUNG TREES.

The pruning of young trees in the orchard should be confined to the removal of adventitious shoots from the stem, and the checking of excessively vigorous growths from the main arms.

It will be noted from Plates 23 and 24 that three main arms have been left on which to build the future tree. Two secondary arms only should be permitted to grow from the ends of each of these main arms in order to develop a strong and well-shaped top. Other secondary arms will grow but should be removed. Undesirable shoots which grow all along the main arms, and which obviously are out of place, would by their continued growth weaken the framework of the tree and should be cut away. In instances where awkwardly-shaped trees are received from the nursery it is often possible to train a shoot which ordinarily

would be out of place to develop and fill up a gap. Such training involves shortening back the required shoot at some dormant period of growth to a bud pointing in the direction it is desired the shoot should grow. Remember that a shoot can be trained in any direction by cutting back to a bud pointing in that direction. Long weak limbs that do not show a tendency to branch should be headed back generally to the limit of the other growths, so that the tree will grow strong, compact, and symmetrical. The top should not be allowed to become too dense; on the other hand it should not be kept so open as to permit the sun scalding the main limbs and branches.

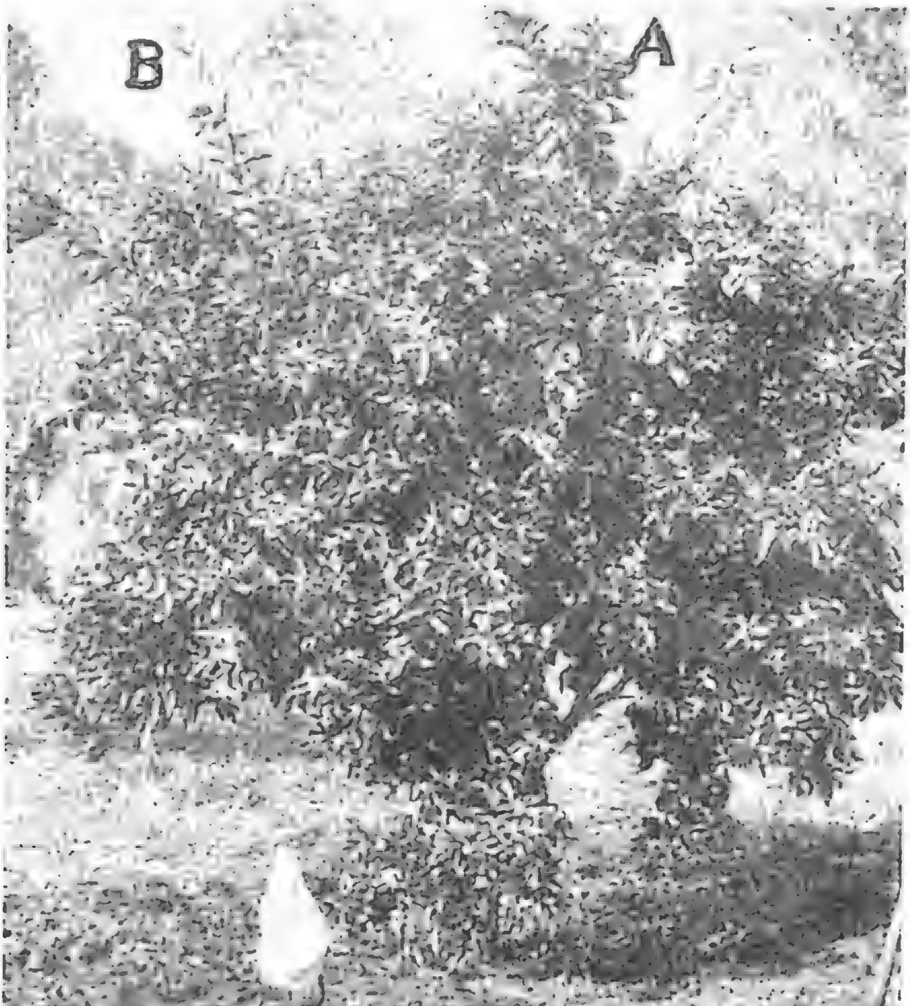


Plate 25.
Four-year-old Valencia Late.

It is worthy of note that where special bud-selected trees have been planted, they have consistently grown into shapely desirable trees and require very little attention from the pruner.

Plate 25 illustrates a young Valencia Late tree showing growth typical of this variety. This tree requires little pruning beyond the removal of any misplaced or excessively vigorous limbs such as those

at the top marked A and B, which can be cut right back to their source. Any dead twigs and crowded foliage would naturally require to be removed.

Plate 27 illustrates a four-year-old Washington Navel and shows typical sucker growths, the treatment of which is sometimes apt to puzzle the pruner.

Plate 26.
The tree in Plate 25 after pruning. Note that the excessively vigorous limbs marked "A" and "B" have been removed.

As a rule such sucker growths may be considered parasitic, but they do not necessarily remain so, for in many instances they later produce bloom and fruit of normal fulness. Generally in practice it is a good plan to remove such growths, remembering that the fact that they can be curbed and induced to fruit makes it possible at times to utilise them for replacing broken and damaged limbs.

Provided that a well-developed framework has been maintained, young well-grown citrus trees should come into profitable bearing at an age of between four and six years. During the first years of bearing pruning should be directed towards the removal of suckers and decadent first-fruiting shoots. Where pruning operations have been diligently carried out on young trees, they require very little pruning during several following years, though they should be gone through annually and suckers and dead wood removed.

There is no doubt that the low production in the case of many old but well cared for orchards is due to the lack of vigorous healthy fruiting wood. This condition points to the necessity for a periodical renewal of fruiting wood, which can be best accomplished by thinning out and at the same time shortening back terminal growths and twigs. The cuts should be made right back to strong new growths, removing weak shoots and those that have borne fruits. The thinning leaves space for the necessary subdivision, whilst the shortening back tends to force into growth dormant buds from behind, stops the excessive growth of any branches, and at the same time renews supplies of

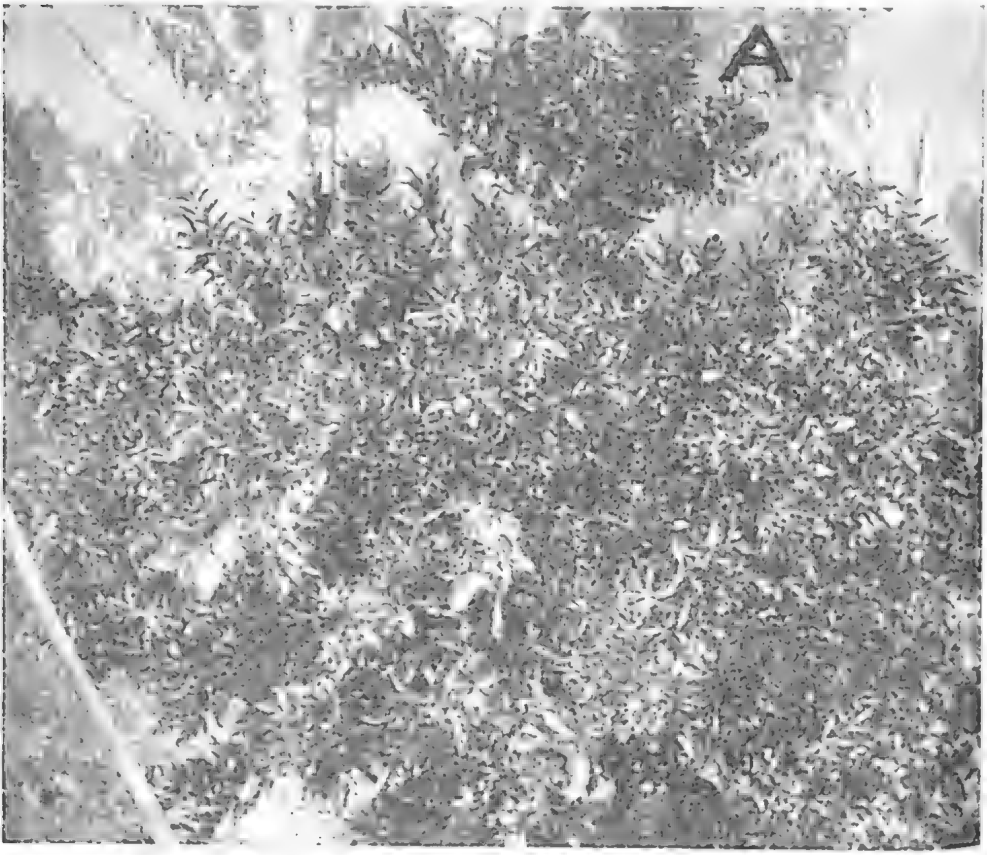


Plate 27.

Four-year-old Washington Navel, showing typical sucker growths.

fruiting wood. Where crowding is evident, the removal of entire branches is at times desirable. The entry of plenty of light and air assists the growth of healthy and vigorous shoots from behind the outside ring of foliage. These shoots make new fruiting wood. Any excessive growth of suckers or water sprouts arising from well inside the tree following heavy pruning require to be cut away or they will absorb a lot of the vigour of the tree and crowd the centre.

In older trees where vitality has been impaired, provision will require to be made for the renewal of old crowded and decadent limbs. In such instances pruning is of a much heavier nature, requiring the removal of entire branches. Such branches should be cut right back to

their source of origin, so that the sap is readily diverted to the remaining limbs, encouraging new fruiting wood. Under no circumstances whatsoever should stubbing be resorted to. In instances where it is necessary to replace the larger limbs the work requires to be done gradually over two or more years to avoid excessive suckering.

Plate 28.

Sucker, marked A at the top of tree shown in Plate 27, after removal.

Lower branches of the trees should not be allowed to touch the ground, as fruit borne on such branches is generally blemished and of poor quality. On the other hand trees should not be pruned too high from the ground. The height to which they should be lifted varies according to circumstances; in most instances knee-high will prove to be satisfactory.

In Queensland the regular thinning and pruning of bearing trees is definitely necessary. Frequent and regular treatment tends to preserve as nearly as possible the balance between the root system and aerial portions of the tree, assists in the control of economical and cultural requirements and counteracting unfavourable climatic conditions.

MANDARINS.

The majority of mandarins when not systematically trained and pruned are often merely shrubs, not trees. They naturally grow very densely, and unless regularly thinned out and shortened back after the fruit has been harvested the massed twigs become so dense that many perish and the remainder are so weakened that only small inferior fruits are produced.

Plate 29.
The tree in Plate 27 after pruning.

The treatment at planting is identical with that of the orange. After the first season from planting numerous vigorous upright shoots arise from the head of the tree. While small these should be thinned, leaving only those which will assist in building a desirable framework. These should be carefully watched, and where the growth becomes too lengthy, shortened in to a lateral growth, and where laterals are not present headed back to the limits of the other growths. Heading back and thinning may be done when the growths have hardened, not when they are soft and growing rapidly. It is possible to check excessive growths by pinching out an inch or so of the tips.

The densely-growing habit of the mandarin, leading to a profusion of weak shoots, is responsible for overbearing and resultant small and inferior fruits at an early age. Providing that a well-developed framework has been maintained, young well-grown mandarin trees may be permitted to bear at four years of age. The annual pruning of bearing

mandarin trees requires the same regular and close attention as in training and forming young trees. The dense growths and crowded branches require to be well thinned out and shortened back to vigorous laterals of current season growth, removing weak twigs and where

Plate 30.
Four-year-old Glen Retreat Mandarin.

possible shoots that have borne fruits. Such annual treatment permitting ample light and the ready circulation of air throughout—(1) greatly increases the vigour of the tree; (2) suppresses surplus growths and twigs; (3) improves the size and quality of the fruit; and (4) provides for the renewal of ample young and vigorous fruiting wood.

LEMONS.

With lemons the general practice with growers has been to prune severely while the trees are young in an effort to control the growth and so produce a strong framework. In some instances such treatment has retarded growth, and certainly it has retarded the early fruiting of the

Plate 31.
Tree in Plate 30 after pruning.

trees. Apart from the necessary trimming at planting, which, similarly to oranges, consists of shortening back and removing broken and bruised roots, and a corresponding shortening back of the head of the tree in such a manner as to produce a strong straight stem with three or four

well-placed arms radiating therefrom, little pruning should be done during the first two or three years. All that is necessary is a light thinning to remove any undesirable shoots that are out of place and would later upset the balance of the tree, and perhaps a shortening of

Plate 32.

Twelve-year-old Glen Retreat Mandarin before pruning.

excessively vigorous shoots. Main upright-growing limbs, evenly spaced, should be selected as main leaders. As the trees get older these become weighted down at the ends by subdivision, and the weight of fruit and strong side shoots will arise from them. These side shoots should be

thinned out, but not all removed. Those left should be shortened back to form spurs which will produce the best fruit. Suitable growths close to the centre of the tree may be left to grow upright and take the place of the first leaders which have been weighed down.

Plate 33.

Twelve-year-old Glen Retreat after pruning.

In time it will be found the tree is built up of series of tiered branches radiating from the main framework. The object of building up the tree in this manner and spurring it is to encourage a fruit-bearing habit. This is explained as follows:—As the fruit weighs the

vertical branches down to a more horizontal position, the vigour of the branches is reduced, and side shoots arising from such branches are, when spurred as outlined above, conducive to fruit production.

When shortening side shoots, the cuts should be made well back into ripe wood, thus throwing the sap into dormant buds. Light wood

Plate 34.
Typical young lemon tree.

issuing from inside the more erect permanent arms may be retained, shortening for spurring, and from time to time renewed. No rank growth should be tolerated unless it is required to continue the work of

Plate 35.
Lemon leader weighted down. Note strong side shoots.

Plate 36.
The fallen leader shown in Plate 35 after thinning and shortening back the side shoots.

some displaced leader. As the limbs drag down it will be necessary from time to time to lift the tree by removing some of the lower limbs.

Plate 37.
Badly framed young lemon.

RENOVATING DECADENT TREES.

The renovating of many of our old citrus orchards which are rapidly failing in productivity and health constitutes a serious problem. The cause of the decline of citrus trees in Queensland is chiefly due to

starvation together with a combination of climatic and soil conditions. The characteristics of decadent trees may be enumerated as follows:—

(1) Increased percentage of small-sized fruits.

(2) Decreased yield.

(3) Dwarfed foliage in the tree tops.

(4) Weak leafless fruiting wood.

(5) Heavy production of weak blossom.

Plate 38.

The same tree illustrated (Plate 37) after pruning.

There are numerous instances where many of our old and decadent trees may be profitably renovated. Several methods have been used in rejuvenating citrus trees—deheading (by which is meant the cutting back of the tree to three or four main arms to within 18 inches to 2 feet of the main stem); a modification of this in which the secondary

Plate 39.
A decadent lemon tree.

branches are stubbed back to a foot or so in length. Both these methods are somewhat severe, as in removing the entire top of the tree, the balance is upset and the rooting system weakened. Skeltonising—a much less severe method—has now found favour and is giving satisfactory results.

The entire framework of the tree is generally left, except where crowded and diseased limbs require to be removed. Cross limbs and unnecessary leaders are cut out or shortened back. An entirely new fruiting system is built up from the remaining skeleton. The degree of severity of cutting back depends upon the condition of the tree. When declining trees are cut back in this manner, it should be remembered

Plate 40.
The same tree shown (Plate 39) after pruning.

that the bark is very susceptible to sun scald and all the exposed limbs must be thickly coated with a suitable whitewash for protection. A simple whitewash formula can be made as follows:—

Quick Lime	7 lb.
Sulphur (powdered)	2 lb.
Salt, flour, or size	1 lb.

As the lime is slaked down, the sulphur and salt should be well stirred in, and sufficient water should be added to bring the mixture to the consistency of a good paint.

[TO BE CONTINUED.]

Lime for Agricultural Purposes.

F. B. COLEMAN, Officer in Charge, and R. A. TAYLOR, A.A.C.I., Inspector and Examiner, Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers and Stock Foods Investigation Branch.

UNDER "*The Fertilisers Act of* 1935," lime for agricultural purposes is dealt with very comprehensively.

The classification set out in the Act with respect to the types of lime for agricultural purposes is as follows:—

(1) Burnt lime, caustic lime, or quicklime—consisting chiefly of lime in the form of calcium oxide (CaO); or

(2) Slaked lime, air-slaked lime, mild lime, hydrated lime—consisting chiefly of lime in the form of hydrate of lime ($CaOH_2$) and/or carbonate of lime ($CaCO_3$), obtained by the slaking of burnt lime; or

(3) Processed lime—consisting of a by-product from a process—chiefly lime in the form of hydrate and/or carbonate of lime; or

(4) Pulverised limestone, marble, coral, or shells—consisting chiefly of lime in the form of carbonate of lime ($CaCO_3$) obtained by crushing or pulverising; or

(5) Earthy lime—consisting chiefly of lime in the form of carbonate of lime ($CaCO_3$) obtained by excavation of the natural substance; or

(6) Gypsum—consisting of lime in the form of hydrated sulphate of lime ($CaSO_4.2H_2O$).

The classification of lime, as shown above, is based upon terms in common use, which describe the process of preparation or manufacture to which the limes concerned have been subjected.

Burnt Lime is obtained as follows:—

Limestone is first quarried and broken into pieces of suitable size. These pieces are placed in a kiln with fuel—in Queensland usually wood—which is ignited. The heat serves to liberate the carbon dioxide from the calcium carbonate, leaving calcium oxide and a quantity of impurities proportionate to the purity of the original limestone.

Pure limestone would contain 56 per cent. calcium oxide and 44 per cent. carbon dioxide; pure burnt lime would contain 100 per cent. calcium oxide. In actual fact the minimum purity of good burnt lime can be accepted as 90 per cent. calcium oxide (CaO). It should be emphasised that the impurities mentioned above, consisting of iron, alumina, magnesia, silica, &c., are naturally present in limestone, and cannot without great expense be removed; moreover, in normal proportions they do no harm and can be disregarded.

It is essential that the limestone should be completely burnt, otherwise the purchaser is buying some of the original limestone at the price of burnt lime.

An analysis of burnt lime indicates whether the limestone has been completely burnt; even if the burnt lime has been partially slaked it is still possible to determine this.

Burnt lime slakes under normal atmospheric conditions, taking in carbon dioxide and water from the air and "altering" from calcium oxide to a mixture of calcium hydroxide and calcium carbonate. This slaking may be considered in two steps:—

At first the calcium oxide alters to calcium hydroxide and calcium carbonate, with calcium hydroxide in much greater proportion than calcium carbonate.

An analysis would show, say—

50 per cent. calcium oxide (CaO) as calcium oxide.
30 per cent. calcium oxide (CaO) as calcium hydroxide.
4 per cent. calcium oxide (CaO) as calcium carbonate.

When the whole of the oxide has "altered," the proportions of the hydroxide and carbonate would be represented by, say—

0 per cent. calcium oxide (CaO) as calcium oxide.
60 per cent. calcium oxide (CaO) as calcium hydroxide.
10 per cent. calcium oxide (CaO) as calcium carbonate.

This slaked lime would then gradually "alter" until it becomes all carbonate, an analysis revealing, say—

55 per cent. calcium oxide (CaO) as calcium carbonate.

This is then a stable article, and undergoes no further change under atmospheric conditions.

Following on the above, it may be assumed that an analysis of—

50 per cent. calcium oxide (CaO) as calcium oxide,
30 per cent. calcium oxide (CaO) as calcium hydroxide,
4 per cent. calcium oxide (CaO) as calcium carbonate.

represents a well-burnt lime that has partially air-slaked.

An analysis such as the following, however, would indicate by the excess of calcium carbonate, compared with calcium hydroxide, the presence of unburnt calcium carbonate, and consequently could be assumed as being a partially-slaked, badly burnt lime:—

50 per cent. calcium oxide (CaO) as calcium oxide.
7 per cent. calcium oxide (CaO) as calcium hydroxide.
22 per cent. calcium oxide (CaO) as calcium carbonate.

Of course the following—

70 per cent. calcium oxide (CaO) as calcium oxide,
0 per cent. calcium oxide (CaO) as calcium hydroxide,
16 per cent. calcium oxide (CaO) as calcium carbonate,

is obviously a freshly-prepared, badly burnt lime.

It must be noted that the percentages given are *calcium oxide* (CaO),—not calcium hydroxide ($Ca(OH)_2$) or calcium carbonate ($CaCO_3$).

When a farmer realises that burnt lime slakes under normal atmospheric conditions, and its percentage of calcium oxide (CaO) and its neutralising value become lower, it is easy to see that burnt lime should be packed and railed as *freshly burnt* material. If the material has

started to slake before being packed and weighed, the purchaser is buying and paying freight on partially slaked lime, which, as above stated, has a lower percentage of lime (CaO) and lower neutralising value.

Thus, a person who pays for burnt lime and asks the manufacturer to slake it for him, unless he gets the *increased "weight equivalent"* of slaked lime, is losing badly on the proposition; in any case he is paying freight on carbon dioxide and water that could be added to the burnt lime on his own property.

Burnt lime should be purchased on the basis of net weight at the place of burning—which in North Queensland is usually some distance from the coast—as, during transit to the coast, an increase in weight could occur (due, as above stated, to taking up of carbon dioxide and moisture) before weighing; if weighed at the coast this increase would be included in the net weight charged for. In other words, 10 tons of burnt lime at the kilns could weigh 11 tons on the coast, with a consequent increased cost to the purchaser.

Ground Burnt Lime is, as its name indicates, burnt lime that has been pulverised by machine without first slaking. One such product is now being offered for sale in Queensland.

The farmer in this case must weigh the additional cost of the material against any advantage in fineness, taking into consideration the facts that although he can easily slake unground burnt lime on his own property, there is no additional freight cost (as with slaked lime) involved with ground burnt lime, providing it is bagged and railed immediately.

Of course the fine state of division would accelerate slaking considerably, and this would not be apparent from appearance—as the original material is already in a fine state.

Slaked Lime, as stated above, is usually obtained by air-slaking—that is, exposing burnt lime to the slaking effects of the atmosphere. A more rapid slaking can be obtained by sprinkling with water; this produces a rapid chemical change, with evolution of heat, and results in a fine, white powder, termed water-slaked or hydrated lime.

With a correctly-made water-slaked lime the amount of water added is about one-third of the weight of the original burnt lime; the resultant product should be practically all calcium hydroxide, and should give a minimum analysis of 70 per cent. calcium oxide (CaO) as calcium hydroxide.

Possibly owing to lack of experience in this method of slaking, and the necessity for careful control with respect to proportions, &c., in order to obtain a "consistent" product, water-slaked lime for agricultural purposes can be stated to be practically absent from the Queensland market.

The slaked lime made by farmers from burnt lime is commonly air-slaked lime.

Of course, water-slaked lime on exposure will gradually alter to air-slaked lime, changing in time from practically pure calcium hydroxide to practically pure calcium carbonate.

The proportion of calcium oxide present and the forms in which it occurs at the time of application to the soil vary with the progress made in the process of slaking; this, of course, causes complications with respect to the amount of lime to be applied.

If burnt lime is purchased, the purchaser should apportion the lime actually applied to the soil into the same number of units as he planned for the original burnt lime.

For instance:—

A farmer buys 10 tons of burnt lime with a neutralising value of 160, planning to apply $\frac{1}{2}$ ton per acre to 20 acres.

When slaked ready for use the total weight may have increased to, say, 12 tons.

The neutralising value will be *reduced* by the slaking.

The lime should still be divided into twenty lots and applied as planned, but the actual weight per acre will now be $\frac{12}{10} \times \frac{1}{2} = \frac{12}{20}$ ton $= 12$ cwt. instead of 10 cwt.

The actual weight of calcium oxide (CaO) applied to the soil will be the same, however.

This is demonstrated thus:—

10 cwt. x neutralising value 160 $= 1{,}600$

12 cwt. x neutralising value $133\frac{1}{3} = 1{,}600$

The neutralising value bears an approximate ratio to the calcium oxide (CaO) percentage.

There is not much of any slaked lime sold as slaked lime in Queensland; as will be seen, only one is registered.

Processed Lime.—In certain industries lime (usually burnt lime) is used in chemical processes, and a resultant lime by-product is obtained. In Queensland, only one lime of this type is offered for sale; when freshly run-off in paste form it contains calcium hydroxide and calcium carbonate, but on being spread out in the open the hydrate gradually alters to carbonate. The final product, when dried, is ground, and constitutes a recognised lime for agricultural purposes.

Pulverised Limestone, Pulverised Marble, Pulverised Coral, or *Pulverised Shells* are the respective natural materials after treating by passing through a crushing or pulverising machine.

The percentage of calcium oxide varies according to the purity of the original material; the calcium oxide is in the form of calcium carbonate. *Pulverised limestone* varies in quality, but, generally speaking, is a fairly high-grade source of lime. It must be ground in a pulverising machine, as is explained elsewhere under the heading of "*Fineness.*"

The degree of fineness is an important factor governing its value. The natural impurities usually present are chiefly magnesia, iron, alumina and silica.

Earthy Lime consists of lime carbonate which is in a naturally disintegrated or friable condition, and is dug out after removal of the "overburden." It is comparatively impure and of a softer nature than limestone. It needs very little treatment before being offered for sale; sieving is usually sufficient to obtain a satisfactory degree of fineness—to which importance should be attached.

The calcium oxide content varies according to the purity of the material—as in pulverised limestone—and is wholly present in the form of calcium carbonate.

Earthy lime should always be screened before being bagged ready for sale.

Magnesian or Dolomitic Lime Carbonates.—A number of natural limestone deposits contain an appreciable quantity of magnesia. When this type of material is marketed in Queensland the maximum percentage of magnesia (MgO) must be declared on the label for the information of the purchaser, who may decide from this percentage whether the product is suited for his particular purpose or otherwise. Reference to the table of registrations will show that one magnesian lime for agricultural purposes is at present on the Queensland market. In this particular instance the material occurs as an earthy lime which requires very little pulverising.

Of course, practically all naturally occurring lime carbonates contain a small amount of magnesia.

It should be noted that the maximum percentage stated on the label refers to magnesia (MgO)—not magnesium carbonate ($MgCO_3$). This is comparable to the declaration of the percentage of calcium oxide (CaO) and not calcium carbonate ($CaCO_3$), as explained under "*Labelling.*"

Gypsum.—Gypsum is a naturally occurring form of lime, and may be described as dihydric calcium sulphate ($CaSO_4.2H_2O$).

It is very little used in Queensland, and although it has a minimum lime content of 32 per cent., it has no actual neutralising value.

No material is registered in Queensland under this name.

Miscellaneous Limes.—From time to time limes for agricultural purposes are placed on the market that owing to the quality of the material used, or difficulties involved in the process of manufacture or preparation, or other factors, do not compare with limes in the group to which they purport to belong.

In these cases they are classified as miscellaneous to allow purchasers to value them on their own merits apart from any group in which they would appear out of line.

Neutralising Value.—This term applies to all limes for agricultural purposes, except gypsum, and affords a means of comparison applicable to these limes.

It is a comparative figure which denotes the ability of the lime in question to neutralise acidity, which is one of the main purposes for which lime is used.

It is a figure ascertained practically, and would include any other carbonates or basic materials present.

The standard of comparison is 100 per cent. pure calcium carbonate, which would have a neutralising value of 100.

Comparative neutralising values would be:—

Burnt lime	160
Slaked lime	120
Pulverised limestone	90
Processed lime	86
Earthy lime	80

Fineness.—With respect to lime sold for agricultural purposes, fineness is of importance with earthy lime, pulverised limestone, pulverised marble, and other pulverised carbonates, and also processed lime.

"Fine" means particles that will pass a sieve with apertures $\frac{1}{100}$ inch square.

The whole of the limes to which fineness applies must pass a sieve with apertures $\frac{1}{8}$ inch square.

Burnt lime is not affected by fineness, and the resultant slaked lime is also exempt from this provision.

Carbonates with equal neutralising values may be compared on a fineness basis.

The reason why fineness applies to earthy lime, processed lime, pulverised limestone, and other pulverised carbonates, and not to burnt or slaked lime, may be set down as follows:—

It has been repeatedly proved *that lime carbonates, unless in a fine state of division, are not rapidly absorbed by the soil, being insoluble in pure water and only slowly soluble in slightly carbonated water—that is, water containing carbon dioxide in small quantity.

Artificial grinding (or screening) is therefore necessary with these materials.

Burnt lime, however, is in large lumps when sold, and of its own accord breaks down on slaking—either artificial or natural—to a fine powder. This powder, being usually largely hydroxide when applied, is fairly water-soluble, and is absorbed readily by the soil.

No artificial grinding is therefore necessary, and a fairly uniform absorption by the soil is obtained from all burnt or freshly slaked limes.

The table on page 99 sets out the various limes being offered for sale within the State.

The Value of Group Names.—The use of names indicating the groups to which the particular limes relate is of importance.

For instance, a purchaser uses the name "Burnt Lime." Now, providing names used are a correct indication, any burnt lime registered would have a neutralising value that should be associated with burnt lime, e.g., say, at least 160.

If he orders a pulverised limestone, irrespective of "specific designation," he would get a material with a neutralising value of, say, at least 90, and with earthy lime, say, 70 to 90.

In addition, with the use of the name "Burnt Lime," he can dispense with fineness, whereas, with pulverised limestones, earthly limestones, &c., he has two factors of importance—neutralising value and fineness.

In short, limes may readily be compared with other limes in their own respective groups, and the strict adherence to this grouping with respect to the names used on the labels is of importance in allowing this comparison to be easily made.

* "Value of Different Forms of Lime," by Dr. H. W. Kerr and C. R. von Stieglitz, Farm Bulletin No. 6, Bureau of Sugar Experiment Stations.

LIMES FOR AGRICULTURAL PURPOSES.

REGISTERED UNDER THE FERTILISERS ACT OF 1935 FOR THE YEAR ENDING 31ST DECEMBER, 1936.

Name and Address of Dealer.	Brand.	Guaranteed Analysis. Calcium Oxide (CaO).	In the under-mentioned Form.	Neutralising Value.	Magnesia (MgO) as Magnesium Carbonate.	Fine.	Coarse.
		Minimum %		Minimum.	Maximum %	Minimum %	%
Burnt Lime—							
Ambrose Lime Works, Ambrose	Ambrose	90	As oxide	160	..	..	..
Crotty Lime Works, Ootann Siding, via Cairns	Crotty	90	As oxide	160	..	..	..
Demchok, M., Mungana	Mungana	90	As oxide	160	..	..	..
Ryan Lime Co. (Pty.) Ltd., Townsville	Ryan	90	As oxide	160	..	..	..
Tamaree Lime Works, Tamaree	Tamaree	90	As oxide	160	..	..	..
Webb & Son, Reid River, N.Q.	Webb's	90	As oxide	160	..	..	..
Burnt Lime (Pulverised)—							
Ryan Lime Co. (Pty.), Ltd., Townsville	Ryan	85	As oxide	150	..	..	..
Slaked Lime—							
Ambrose & Sons, H., Tamaree	Tamaree	5 45 11	As oxide As hydroxide As carbonate	120	..	..	..
Processed Lime—							
A.C.F. & Shirleys Fertilizers Ltd., Brisbane	A.C.F. Hydrolime	47	As carbonate	88	..	50	50
Australian Chemical Co. Ltd., Brisbane	Acco	47	As carbonate	88	..	50	50
Pulverised Limestone, Marble, &c.—							
Ambrose Lime Works, Ambrose	Ambrose	50	As carbonate	90	..	84	16
Crotty Lime Works, Ootann Siding, via Cairns	Crotty	51	As carbonate	92	..	77	23
Gibbs, Bright, & Co., Brisbane	S.C.	50	As carbonate	91	..	60	40
Marberete Co., Valley, Brisbane	Marberete	55	As carbonate	99	..	44	56
Ryan Lime Co. (Pty.) Ltd., Townsville	Ryan	50	As carbonate	90	..	50	50
Earthy Lime—							
Breen & Olsen, Marmor Lime Works, Marmor	Breen & Olsen	51	As carbonate	90	..	70	30
Bryant C. J., Didcot, Gayndah Line	Didcot	47	As carbonate	80	..	74	26
Ryan Lime Co. (Pty.) Ltd., Townsville	Ryan	45	As carbonate	80	..	30	70
Webb & Son, Reid River, N.Q.	Webb's	45	As carbonate	80	..	30	70
Containing Magnesia—							
Inkerman Lime Co., Inkerman	Inkerman	43	As carbonate	85	7	60	40

Fine means particles that will pass a seive with 1/100″ square apertures.

Labels.—The method of labelling lime with respect to lime content (as indicated also in the Table) is as follows:—

The percentage or percentages of calcium oxide (CaO) and the respective forms in which it occurs must be stated. This means that, with slaked limes or carbonates, not the percentage of calcium hydrate and percentage of calcium carbonate should be stated, but the percentages of calcium oxide (CaO) that are present in each of those forms.

Let us take a partially air-slaked lime for an example. This may consist actually of—

50 per cent. calcium oxide,
40 per cent. calcium hydroxide, and
5 per cent. calcium carbonate,
with, say, 5 per cent. impurities.

Now, in the calcium hydroxide and calcium carbonate, only the percentages of calcium oxide (CaO) can be called active constituents.

To compare with burnt lime containing, say, 90 per cent. calcium oxide (CaO), all as calcium oxide, this lime must be reduced to a common basis. In other words, to compare with a material that has lime present only as calcium oxide (CaO), the percentages of calcium hydroxide and calcium carbonate must also be reduced to the amount of calcium oxide (CaO) that they contain—the forms in which the calcium oxide (CaO) occurs being, of course, also stated.

Thus, the label would read—

	50	per cent. calcium oxide (CaO) as calcium oxide
	30	per cent. calcium oxide (CaO) as calcium hydroxide
	2·8	per cent. calcium oxide (CaO) as calcium carbonate
Total	82·8	per cent. calcium oxide (CaO).

On this figure the material can then be compared with any other lime on a total calcium oxide (CaO) basis.

Of course, the neutralising value gives a definite method of comparison, but it includes magnesia and other neutralising material, and is a comprehensive figure only; also, of course, the neutralising value does not indicate the form or forms in which the calcium oxide occurs, and is of value only with respect to neutralising soil acidity.

It is provided by the Fertilisers Act that all limes for agricultural purposes shall be labelled in such a manner as to set out:—

The kind of lime;

The percentage of calcium oxide (CaO) and the form or forms in which it occurs;

The neutralising value;

The net weight;

The percentage of fineness (except in the case of lime which has been burnt); and

The name and address of the manufacturer or dealer.

The following sets out examples of labels:—

BURNT LIME FOR AGRICULTURAL PURPOSES.

When packed, lb. net.

90 per cent. Calcium Oxide (CaO) as Calcium Oxide.

Neutralising Value, 160.

(Name and Address of Manufacturer or Dealer.)

PULVERISED LIMESTONE FOR AGRICULTURAL PURPOSES.

When packed, lb. net.

50 per cent. Calcium Oxide (CaO) as Calcium Carbonate.

Neutralising Value, 90.

Fine, 80 per cent. Coarse, 20 per cent.

(Name and Address of Manufacturer or Dealer.)

EARTHY LIME FOR AGRICULTURAL PURPOSES.

When packed, lb. net.

45 per cent. Calcium Oxide (CaO) as Calcium Carbonate.

Neutralising Value, 80.

Fine, 65 per cent. Coarse, 35 per cent.

(Name and Address of Manufacturer or Dealer.)

MAGNESIAN EARTHY LIME FOR AGRICULTURAL PURPOSES.

When packed, lb. net.

43 per cent. Calcium Oxide (CaO) as Calcium Carbonate.

7 per cent. Maximum Magnesia (MgO) as Magnesium Carbonate.

Neutralising Value, 85.

Fine, 60 per cent. Coarse, 40 per cent.

(Name and Address of Manufacturer or Dealer.)

This article deals only with the legislation controlling the sale and quality (both chemical and physical) of the various limes for agricultural purposes, that are sold within this State.

Any information desired as to the actual use or application to the land for specific purposes should be directed to the other branches of the Department that are concerned.

Summary.

The chief original source of lime for agricultural purposes in Queensland is limestone rock.

The principal kinds of lime derived from this are as follows:—

Burnt Lime.—This is made by burning lumps of limestone, and providing it is packed and railed when freshly burnt, is a "concentrated" source of lime. It is to the farmer's advantage to slake burnt lime on his own property.

An average quality burnt lime should analyse—

90 per cent. calcium oxide (CaO) as calcium oxide, and neutralising value, 160.

Burnt lime is used in certain chemical processes; the resultant by-product is known as *Processed Lime*, and contains the calcium oxide (CaO), chiefly in the form of carbonate.

An average quality processed lime should analyse:—

46 per cent. calcium oxide (CaO) as calcium carbonate, neutralising value, 86; fine, 50 per cent.; coarse, 50 per cent.

Pulverised Limestone is the original rock quarried and ground. An average quality material should analyse:—

50 per cent. calcium oxide (CaO) as calcium carbonate, neutralising value, 90; fine, 80 per cent.; coarse, 20 per cent.

Other important limes for agricultural purposes are:—

Earthy Lime, which is an impure form of lime carbonate that can easily be worked by digging, being softer than limestone, and usually requiring screening only. An average quality material should anlayse:—

45 per cent. calcium oxide (CaO) as calcium carbonate, neutralising value, 80; fine, 65 per cent.; coarse, 35 per cent.

Magnesian Limes for Agricultural Purposes, which are pulverised limestones or earthy limes containing appreciable quantities of magnesia.

The maximum percentage of magnesia (MgO) as magnesium carbonate must be declared on the label, and this should be considered by the farmer with a view to the application of the material for particular purposes.

Efficiency of Lime for Agricultural Purposes.—Limes which have been burnt may be compared on a neutralising value basis only.

Other forms of lime may be compared within their own respective groups on a neutralising value and fineness basis.

Labels should set out the—

Kind of lime,

The percentage of CaO and forms in which it occurs,

The neutralising value,

The net weight,

The fineness (unless prepared by burning),

The name and address of the manufacturer or dealer.

Buyers of lime of a greater value than 10s. should receive an invoice bearing the warranty required by the Act with respect to the quality of the article.

On no account should purchasers accept delivery of lime for agricultural purposes that is not labelled and invoiced in the manner outlined above.

All complaints or inquiries should be addressed to the Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch, Department of Agriculture and Stock, Brisbane.

REGISTERED STALLIONS.

Subjoined is a list of stallions in respect of which Certificates of Registration were issued under *"The Stallions Registration Acts,* 1923 *to* 1934," during the year 1936-37:—

BLOOD STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1936–37.

Name.	No.	Age.	Description.	Owner.
Admontem	1710	Aged	Chestnut ..	J. Allingham, Kangaroo Hills, Ingham
Aladdan	1498	6	Grey	N. G. Walker, Iveragh
Astor King	1688	5	Bay	R. Sta.k, M. P. Creek, Wondal
Ben Art	1423	5	Chestnut ..	A. G. Anderson, Hendra
Bernfield	1711	Aged	Brown ..	M. Meehan, Toonpan
Bill Savin	1689	6	Iron grey ..	W. L. Wieckhorst, Tingoora
Black Guard	1243	6	Black ..	R. Betts, Boonah
Bollitree	1418	5	Bay	R. De la Bere Hill, Unumgar
Boystock	1712	Aged	Bay	A. Cox, Ayr
Brutus	1618	6	Brown ..	S. S. Webb, Toowoomba
Bubble	1492	5	Bay	J. B. Shannon, Tooloombah
By Golly	1690	5	Brown ..	F. Cockrell, Archookoora
Cavalier	1378	6	Bay	R. J. D'Arcy, Glenrock, Gatton
Chieftain	1691	5	Iron grey ..	Hunter Bros., Cinnabar
Cottingham	1408	Aged	Chestnut ..	H. T. Sheppard, Greenbank
Denis Lad	1411	6	Chestnut ..	G. E. Crane, Elbow Valley
Diamond	1427	6	Bay	W. Gunn, Goondiwindi
Don Pride	1692	5	Brown ..	C. Svenson, Bundaberg
Duinatic	1693	5	Bay or brown	J. Drinan, Wallaville
Dux	1619	5	Brown ..	R. Fawcett, Toowoomba
Emblem Mat	1695	5	Iron grey ..	W. Elsebach, Gayndah
Embleso	1696	5	Brown ..	L. Wedemeyer, Eidsvold
Falling Star	1458	5	Brown ..	A. C. Williams, Homevale, Nebo
Father's Footsteps ..	1420	5	Brown ..	Miss D. O'Neill, Lisson Grove, Clayfield
Flavic's Son	1459	6	Brown ..	W. G. Ney, Nebo
Frolic	1460	5	Brown ..	E. L. G. Johnson, Orkabie
Gaine Carrington ..	1425	Aged	Chestnut ..	T. Jennings, Greenmount
Glengarry	1493	5	Brown ..	W. C. Dickinson and Sons, Boynedale
Glenlock	1461	Aged	Brown ..	Cook and Cook, Wandoo, Koumala
Glen's Spear	1416	5	Brown ..	G. Cameron, Marian, Mackay
Gold Dust	1713	6	Bay	A. R. Foot, Reid River
Goldie	1379	Aged	Chestnut ..	W. E. Houston, Blackbutt
Gold Syce	1697	5	Chestnut ..	D. V. Wagner, Aranbanga, Gayndah
Gun Mark	1428	5	Black ..	T. Phelan, Gladfield
Hastate	1417	5	Bay	W. A. Collins, Cairns
Herriot	1714	Aged	Bay	Estate J. S. Love, Egera, Charters Towers
Imitate	1415	5	Brown ..	E. S. Cox, Upper Paddington
Jimsard	1462	Aged	Chestnut ..	W. J. Edwards, Mirani West
Kentabie	1698	5	Brown ..	P. J. Bishop, Mundubbera
Kerbat	1494	Aged	Brown ..	T. H. Craig, Broseley, Miriam Vale
Kildare	1463	Aged	Brown ..	D. W. Blyth, Koumala
King Emblem	1699	5	Brown ..	C. E. Pascoe, Ceratodus
King John	1715	Aged	Bay	Queensland Stud Limited, Wandovale
Knight Gold	1716	Aged	Bay	C. Schultz, Woodhouse, Ayr
Ladowee	1717	5	Brown ..	C. B. MacPherson, Mingela
Le Cornett	1718	Aged	Chestnut ..	Mrs. F. Calcott, Low Holm, Pentland
Lord Poitrel	1719	Aged	Bay or brown	Trustees J. Allingham, Hillgrove, Charters Towers
Major Hardy	1380	Aged	Bay	P. A. Peach, Upper Tent Hill
Mane Berd	1429	6	Bay	R. Devlin, Mill Hill
Master Persse ..	1381	5	Chestnut ..	E. J. Griffiths, Mount Forbes
Meloa	1720	Aged	Chestnut ..	T. Naughton, Broughton, Charters Towers
Menelaus	1700	5	Brown ..	Mrs. J. B. Salter and Sons, Biggenden
Mikado	1701	6	Bay or brown	G. R. Briggs, Swindon, Mount Perry
Moon Mirror	1497	5	Chestnut ..	G. Cunningham, Lion Mountain, Rockhampton
Mount Lad	1620	5	Grey ..	A. D. Orr, Aubigny
Mr. Singer	1382	5	Bay	P. Tuite, Toogoolawah
Nappatarra	1430	Aged	Bay	Leonard and Sons, Welltown
Oddenda	1621	6	Brown ..	P. T. Dwyer, Maclagan
Oratory	1722	Aged	Brown ..	A. W. Fadden, Executor Estate J. S. Love, Townsville
Orb	1464	5	Bay	E. G. Lascelles, Proserpine
Othello	1721	Aged	Bay	A. Shepherd, Milray, Pentland
Pan Yan	1723	Aged	Brown ..	S. Vaughan, junr., Bohle River
Playbox	1465	5	Grey	A. C. Williams, Homevale, Nebo
Pommy	1725	Aged	Bay	B. Anning, Cargoon
Prince Kerman ..	1431	Aged	Bay	P. J. Brosnan, Kooreela, New South Wales
Prince Orange ..	1622	5	Chestnut ..	D. Wormwell, Athlone, Meandarra
Robemond	1422	5	Black or brown	R. Baker, Caboolture
Saint Hero	1623	5	Chestnut ..	J. A. Bridge, Tara
Sarauda	1495	5	Chestnut ..	P. J. Hanrahan, Gogango
Serlodi	1424	6	Brown ..	W. H. Reynolds, Hamilton, Brisbane
Showfelt	1624	5	Brown or black	J. L. Thompson, Brookstead
Sinclair	1383	6	Bay	G. McLean, Esk
Sir Dignity	1433	5	Chestnut ..	Rae and Doyle, Bungunya
Sir Force	1434	5	Bay	A. G. Rowling, Texas
Sir Monarch	1421	5	Brown ..	T. Jennings, Greenmount
Song Time	1724	Aged	Chestnut ..	Estate of J. S. Love, Egera, Charters Towers
Sonny Boy	1702	Aged	Bay	A. M. Deighton, Gympie
Sonny Boy	1409	6	Bay	A. C. Corrie, Oxley

BLOOD STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1936-37—*continued.*

Name.	No.	Age.	Description.	Owner.
Stout Fella	1436	Aged	Bay	C. Webster, Newinga, Talwood
St. Stephen	1432	5	Chestnut ..	Wright and Sons, Goondiwindi
Sunshine	1625	5	Bay	A. R. Curd and Sons, Jandowae
Thalacre	1626	6	Bay	R. W. Jahnke, Rywung
Tooloomba	1496	5	Brown ..	J. W. Mylrea, Canoona
Townie	1703	Aged	Bay	S. B. Trigger, Lakeside
Treken	1410	5	Chestnut ..	G. F. Scott, Beaudesert
Turkish Prince ..	1704	5	Brown ..	E. Zillman, Wallaville
Vertibra	1726	Aged	Black ..	Mrs. A. Black, Jajingo, Charters Towers
Victor	1705	6	Chestnut ..	R. Sommerfield, Tinana
Volunteer	1706	Aged	Chestnut ..	A. L. Gaden, Molangool
War Sash	1727	5	Dark bay ..	W. D. White and Sons, Bluff Downs
Weirwedge	1437	Aged	Bay	T. Flood, Goondiwindi
Winaspear	1384	5	Bay	C. Harsant, Harrisville
Wondul	1438	Aged	Bay	W. Sharp, Goondiwindi
Wyvern	1728	Aged	Dark chestnut	E. E. D. White, Bluff Downs
Xoanon	1467	5	Chestnut ..	J. Andrews, Dornford, Bowen

PONY STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1936-37.

Alec	1488	6	Brown ..	J. Blakely, Sarina
Barney Google ..	1627	Aged	Brown ..	H. C. McKee, Duleen, Dalby
Bay Boy	1391	6	Bay	J. Kennedy, Pine Ridge, Southport
Bonnie Boy	1707	5	Bay	C. Jose, New Moonta
Bonny Blue	1729	5	Black ..	W. H. Bryant, Hewitt street, Charters Towers
Bonny Lad	1386	5	Cream ..	I. G. Bonney, Rosewood
Boonah Jewel ..	1392	5	Black ..	C. Sproxton, Maleny
Circus	1393	5	Piebald ..	J. Fenton, Beaudesert
Danny Boy	1439	5	Bay	J. Flynn, Clifton
Emir	1730	Aged	Black ..	Mount Elsie Estate Co., Mount Elsie
Harpace	1387	Aged	Bay	C. Arnold, Toogoolawah
La Cigale	1440	5	Bay or brown	R. C. Cooke, Upper Pilton, Clifton
Little Tom	1708	Aged	Grey ..	G. I. Titmarsh, Maryborough
Lord Loch	1412	5	Iron grey ..	J. Kenny, Lismore
Novelty	1628	5	Black ..	T. H. Saville, Ascot Mail, Greenmount
Nuggett	1709	5	Brown ..	H. Schmidt, Coringa, Degilbo
Prince	1441	Aged	Brown ..	J. A. Murray, Lagoon Flat, Texas
Red Robin	1442	6	Chestnut ..	E. F. Blomley, Eagle Bar, Bungunya
Shamrock	1389	6	Brown ..	C. A. Kanofski, Grandchester
Silver Dandy	1489	5	Taffy.. ..	W. J. S. Pitcher, Bell's Creek, Sarina
Silver King	1443	Aged	Grey ..	D. G. Cross, Boorandalla, Texas
Spotlight	1629	5	Brown ..	H. V. Farquharson, Ramsay, Cambooya
Stockings	1490	5	Chestnut ..	G. K. Gordon, Mount Pleasant, Binbee
Tom	1395	Aged	Dark bay ..	W. Morrison, House Mountain, Samford
Toy	1731	Aged	Chestnut ..	C. Meehan, Toonpan
Treasure	1396	5	Light chestnut	V. W. Francis, Cooran
Welsh Pride	1390	6	Piebald ..	J. Greenfield, Gatton
Wildfire	1491	6	Chestnut ..	G. K. Gordon, Mount Pleasant, Binbee

TROTTER STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1936-37.

Abbey Patch	1385	5	Cream ..	F. A. Hoger, Gatton
Childe Era	1486	Aged	Bay	C. Morgan, Chelona, Mackay
Grand Bells	1487	5	Chestnut ..	J. E. Kelly, Bowen
Machine Mantle ..	1426	6	Bay	R. G. Morrell, Elphinstone
Monto Wilkes.. ..	1499	5	Black ..	A. Thomasson, The Caves
Sparkling Ribbons ..	1419	5	Bay	P. D. Fiechtner, Greenmount
Vale Opera ..	1687	6	Dark chestnut	L. T. Graham, Goomeri

DRAUGHT STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1936-37.

Allora Crystal ..	1445	5	Bay	W. Lysaght, Clinton Vale
Andrew Boy	1630	5	Brown ..	W. Biegel, Rywung
Athaldo	1476	Aged	Brown ..	C. J. Harding, Delta, Bowen
Baron	1732	Aged	Bay	W. H. F. Wordsworth, Manton, *via* Townsville
Baron Fancy	1631	5	Bay	S. Otto, Bum Bum Creek, Crow's Nest
Baron's Pride ..	1760	5	Bay	F. Mundey, Gladfield, Warwick
Baroona Badger ..	1733	Aged	Chestnut ..	Burke Bros., Brandon
Bay Boy	1756	5	Bay	L. Ryan, Baringha, G.N.R.
Bay Prince	1242	Aged	Bay	J. Cruice, Durundur, Woodford
Beau Ideal	1673	5	Bay	A. H. Greenup, Bancroft, Monto
Ben Bolt	1632	Aged	Bay	J. Ross, Captain's Mountain, Milmerran
Black Prince	1633	5	Black ..	J. Simmons, Coo-ee Ville, Milmerran
Blue Peter	1500	5	Blue roan ..	W. J. Lewis, Velindre Farm, Wowan
Bob of Abbotsleigh ..	1667	5	Bay	Estate W. C. Collins, Rosedale
Bold Lad	1674	Aged	Bay	A. T. Simpson, Aramara
Bold Laddie	1244	5	Bay	T. Armstrong, Rosewood
Bold Prince	1245	5	Bay	G. A. Heise, Minden
Bowler..	1734	5	Bay	T. Kelly, Ayr
Bowler..	1634	5	Bay	T. Gadsby, Wooleebee Junction
Brilliant Master ..	1675	5	Bay	R. Stark, M. P. Creek, Wondai

DRAUGHT STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1936-37—*continued*.

Name.	No.	Age.	Description.	Owner.
British Prince ..	1246	5	Bay	M. O'Neill, Rockton, Peak Crossing
Briton	1447	6	Bay	R. Chandler, Forest Springs, Clifton
Brown Son	1735	Aged	Dark bay ..	Mrs. A. Haighton, Cuba Plains, Pentland
Browntyre	1468	Aged	Bay	M. M. Gordon, Grosvenor Downs, Nebo
Byron Minor	1413	Aged	Black ..	A. F. McLean, Paradise East, Elsmore, New South Wales
Captain	1676	5	Bay	H. Kopp, Degilbo
Captain	1469	5	Bay	A. Teitzel, Mount Dangar, Bowen
Captain	1736	Aged	Dark bay ..	J. Kelso, Townsville
Captain	1635	6	Bay ..	T. B. Freeman, Columboola
Captain	1737	Aged	Bay	Clark Bros., Mirtna, Charters Towers
Captain	1485	6	Bay	D. A. Roberts, Bundarra, Nebo
Carlyle..	1636	5	Bay	M. J. Sommer, Goombungee
Carlyle Clinker ..	1448	5	Black ..	J. Gilmour, Springvale, Goomburra
Carlyle Perfection ..	1637	Aged	Bay	J. V. Willis, Meringandan
Chief	1638	5	Brown ..	J. A. Hick, Jackson
Chieftain	1738	Aged	Light bay ..	Hoey Bros., Brandon
Chinchilla Prince ..	1640	5	Black ..	H. L. Zerbst, Wamba Creek, Chinchilla
Chrystal	1639	5	Brown ..	N. R. Trousdell, Pinelands
Clyde Hill Intent ..	1406	5	Bay	J. Lehmann, Coolana, *via* Rosewood
Clydemere	1641	5	Bay	S. Hartwig, Groomsville, Pechey
Crown Duke	1643	5	Bay or brown	H. C. Dornbusch, Cross Hill, Oakey
Crystal's Pride ..	1449	5	Bay	A. F. Watt, Freestone
Cub	1677	6	Bay	G. A. Pollock, North Kolan
Danny	1644	5	Bay	L. Lloyd, Wandoan
Darkie	1470	Aged	Black ..	E. Hannon, Savannah
Darwin	1678	5	Bay	C. Cavanagh, junr., Kybong
Dobbin	1645	5	Bay	S. Marriage, Glenbrae, Narko
Don	1739	5	Brown	W. Porter, Home Hill
Don	1740	Aged	Bay	W. McLellan, Ayr
Donald Boy	1646	6	Bay	J. W. Wormwell Estate, Athlone, Meandarra
Don Bute	1668	5	Bay	H. C. Willert, Berajondo
Duke	1741	5	Bay	T. Cass, Balfe's Creek
Gay Lad	1397	5	Bay	G. White, Petrie
Glenlea Pride ..	1471	5	Bay	J. T. Dumma, Kuttabul
Haile Selassie ..	1669	5	Bay	W. A. Priddis, Wowan
Hermitage Lad ..	1450	5	Bay	H. A. Gillespie, Hermitage
Hero	1679	5	Chestnut ..	J. M. Taylor, Ness Farm, Childers
Highland Land ..	1647	5	Bay	E. H. Volker, Flagstone Creek, Helidon
Intent	1472	5	Bay	Land Bros., Eton Vale, Binbee
Irton Lustre	1247	5	Bay	West Moreton Horse Breeders' Association, Laidley
Jim Crow	1757	Aged	Brown ..	J. J. Webber, Ayr
Jolly Boy	1648	6	Dark bay ..	A. Hair, Lucksall, Dulacca
Jondaryan Janitor ..	1680	5	Bay	C. G. Walker, Tarong
Jondaryan Mac ..	1248	5	Bay	B. G. Kerle, Minden
Kadlunga	1742	Aged	Grey ..	W. D. White and Sons, Bluff Downs, Charters Towers
Landmark	1743	Aged	Chestnut ..	H. Bawden, Reid River, N.Q.
Larry	1649	Aged	Black ..	G. Stephens, Kiama, Hannaford
Lone Star	1451	5	Bay	Gross Bros., Campbell's Plains, Warwick
MacWallace	1744	Aged	Bay	G. Linton and Sons, Home Hill
Major	1651	Aged	Brown ..	Wellcamp Pastoral Co., Wellcamp
Major Dale	1249	5	Bay	C. A. Kanofski, Grandchester
Major Wallace II. ..	1398	5	Bay	F. A. Doeblein, Burnside, Yatala
Major Wylie	1653	5	Brown ..	H. Newton, Squaretop
Master Wheeler ..	1473	5	Brown ..	F. Bundesen, The Range, Eton
Model Farm Champion	1474	5	Bay	A. C. Williams, Homevale, Nebo
Model Meredin ..	1414	5	Brown ..	R. Stokes, Collingwood, Victoria
Montie	1745	5	Brown ..	C. B. MacPherson, Mingela
Moonlight	1746	Aged	Chestnut ..	W. C. Dennis, Selheim
New Hope	1650	5	Bay	E. Erhich, Greenmount
Noble	1681	5	Bay	T. O'Meara, Gleneden, Humphrey
Nobleman	1653	5	Dap. grey ..	J. R. H. Frizzell, Southbrook
Nugget Brown ..	1475	6	Brown ..	F. De Costa, Orkabie, N.C.L.
Oakvat Chancellor ..	1682	5	Brown ..	F. E. Mitchell, Silverleaf, Murgon
Power	1399	6	Bay	J. W. Gooding, Southport
Pride Again	1747	Aged	Bay	G. W. Davenport, Ayr
Pride of Dartmoor ..	1654	5	Bay	Mrs. E. H. Egan, Mount Tyson
Pride of Kinkabilla ..	1655	5	Bay	J. D. Dransfield, Kinkabilla, Meandarra
Pride Sheppard ..	1656	5	Bay	A. C. Kreig, Brookstead
Prince	1477	5	Chestnut ..	J. S. McFarlane, Eton
Prince	1670	5	Bay	H. A. McCartney, Yaamba
Prince	1452	5	Bay	J. W. Bickers, Kurrumbul
Prince	1250	5	Bay	R. E. Turpin, Lowood
Prince	1478	6	Bay	W. Watts, Wereena, Prosperine
Prince Campbell ..	1375	5	Bay	G. McKenzie, Dayboro'
Prince Foot	1671	5	Brown ..	J. C. Bayliss, Heathwood, Miriam Vale
Prince Henry ..	1400	5	Black ..	H. F. Storr, Beerburrum
Prince Henry ..	1657	5	Brown ..	F. D. Lipp, Greenmount
Prince Thomas ..	1658	5	Brown ..	A. Orr, Mount Irving, Aubigny
Prince Walston ..	1758	Aged	Bay	D. Meehan and Sons, Toonpan
Punch	1683	Aged	Roan.. ..	Hunter Bros., Mount View, Cinnabar
Punch	1659	Aged	Bay	A. J. Morris, West Haldon
Punch	1748	5	Bay	G. B. Klumpp, Home Hill
Rajah	1479	5	Chestnut ..	H. Ivers, Rosella, Mackay

DRAUGHT STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1936-37—*continued.*

Name.	No.	Age.	Description.	Owner.
Renown II.	1401	5	Bay	J. T. Collett, Pomona
Ripplevale Treasure	1660	5	Bay	J. V. Willis, Meringandan
Roan Oak	1480	Aged	Roan	W. H. Gillham, Suttor Creek, Nebo
Robin	1661	Aged	Bay	W. S. Lumley, Milmerran
Royal	1481	Aged	Black	C. Zunker, Rosella, Mackay
Royal Dale	1402	5	Bay	C. Sproxton, Maleny
Royal Glencoe	1453	5	Brown	J. M. Thompson, junr., Stanthorpe
Royal Hope	1454	5	Bay	J. A. Murray, Lagoon Flats, Texas
Royal Master	1749	5	Bay	D. P. Jack, Brandon
Salamoniac	1455	5	Bay	Evan's Bros., Oona Vale, Goondiwindi
Scotchman	1403	Aged	Grey	M. J. Mangin, Goodna
Scotland	1750	6	Brown	J. Brabon, Harold street, West Townsville
Seargent	1662	5	Bay	E. A. Ward, Meandarra
Sheperd	1663	5	Bay	C. F. Nauschatz, Jandowae
Shepherd Hill Prince Charley	1684	5	Bay	R. B. Jeffries, Johnstown, Nanango
Sirdar	1751	Aged	Brown	Drysdale Bros., Pioneer
Star	1752	Aged	Brown	F. Cross, Mingela
Statesman	1753	Aged	Black	W. D. White and Sons, Toomba, N.Q.
St. Helen's Bruce Dale	1664	6	Bay	C. B. Bazley, Tipton, Dalby
St. Helen's Captain Windermere	1685	5	Bay	A. Sippel, Redgate, Murgon
The Rajah	1754	6	Brown	Mrs. E. C. Clarke, Maryvale, Charters Towers
Toby	1457	6	Bay	D. F. Marshall, Kondor, Goondiwindi
Toby	1482	Aged	Roan	H. A. Flohr, Wotonga, Nebo
Top Halls	1376	5	Bay	H. F. Dickfos, Gap View, Kalbar
Trimmer	1665	5	Bay	J. H. Morris, Hannaford
Trooper	1755	Aged	Black	R. C. Ramsay, Mingela
Wallace Monarch	1404	5	Bay	J. Murray, Bromelton, Beaudesert
Warrior	1759	5	Bay	W. Jackson, Myola, Balfe's Creek
Willie Mac	1405	5	Bay	W. A. K. McAulay, Yandina
Windermere Cellus	1686	5	Bay	L. C. Walker, Bingera
Worthy Prince	1666	5	Bay	Baumgarten and Sons, Meandarra
Wyaga	1456	5	Bay	Munro and Turner, Goondiwindi
Yacum	1484	5	Bay	J. Renwick, Proserpine
Young Dale	1672	5	Bay	J. B. Shannon, Tooloomba, Rockhampton
Young Hero	1377	5	Brown	G. C. Reinke, Minden

BLOOD STALLIONS CERTIFICATED FOR THE YEAR 1936–37.

Archer	1370	3	Brown	L. E. Gosson, Nanango
Beebo Shell	1152	3	Chestnut	D. W. Bell, Beebo
Bender Boy	1223	4	Bay	W. E. Stevens, 16 Mile Creek, Chinchilla
Bernor	1383	4	Bay	C. Meehan, Toonpan
Black Magic	1288	4	Brown	C. E. Froggatt, Nebo
Bon Aero	1138	3	Bay	P. Brennan, Jimboomba
Bronzoldo	1139	4	Chestnut	J. Daniels, Canungra
Brown Lock	1119	4	Bay	J. Reid, Glamorgan Vale
Brown Poitrel	1371	4	Brown	A. G. Cross, Kingaroy
Cannon King	1224	4	Chestnut	J. Thomas, Cooyar
Carawob	1225	4	Brown	D. Wormwell, Meandarra
Daily Leader	1153	4	Bay	S. C. Luck, Warwick
De-Wedge-Man	1155	3	Brown	R. Newman, Goondiwindi
Flywedge	1154	3	Brown	N. Wright, Goondiwindi
Gold Arrow	1226	4	Chestnut	S. S. Morris, West Haldon
Gold Dust	1227	4	Brown	W. J. Brazier, Jandowae
Golden Leaf	1384	4	Chestnut	C. W. A. Wordsworth, Manton
Havalock	1372	4	Brown	F. G. Willert, Goomeri
Hecla	1385	4	Brown or black	W. T. Wharton and Co., Lolworth
High Eagle	1228	4	Brown	R. C. K. Lethbridge, Mitchell
Idol Answer	1373	3	Brown	R. Webb, Beaconsfield
King Leo	1120	4	Bay	J. Stenzel, Carney's Creek
King's Colours	1289	4	Bay	G. M. Myers, Nebo
Lavender	1374	4	Chestnut	R. Sims, Aramara
Lord Leopolis	1229	3	Brown	Misses J. and N. Pomeroy, Toowoomba
Marlboro	1230	3	Chestnut	O. G. Ridge, Toowoomba
Master Cypher	1311	4	Bay	Miss G. E. Perrier, Mount Larcom
Mick Hatten	1137	3	Bay	H. Golz, Fassifern
Muscatel	1121	3	Bay	P. E. Logan, Upper Tent Hill
My Paddy	1231	3	Brown	H. A. Clark, Tara
Pandosto	1218	4	Brown	O. G. Ridge, Toowoomba
Pathfield	1310	4	Chestnut	F. Smith, Beaconsfield
Polyphonic	1375	3	Chestnut	M. MacDonnell, Gympie
Sea Laddie	1122	4	Black	T. J. Ford, Gatton
Senator	1319	4	Bay	R. G. Mackay, Morinish
Serf King	1290	4	Chestnut	A. T. Wellby, Mackay
Shumar	1232	4	Chestnut	H. V. Farquharson, Drayton
South Kerman	1123	4	Chestnut	J. H. Heck, Glamorgan Vale
Starlight	1376	3	Black	Mrs. L. J. Mackaway, Goomeri
Sunrise	1377	3	Chestnut	E. N. Sawtell, Coolabunia
Tantitha	1378	3	Bay	G. Briggs, Childers
Taubada	1233	4	Bay	Mrs. R. V. Breydon, Haden
Tibicen	1217	4	Bay	I. J. Moore, Ascot
Waratah	1379	4	Bay	G. W. Nahrung, Miva

BLOOD STALLIONS CERTIFICATED FOR THE YEAR 1936–37—*continued.*

Name.	No.	Age.	Description.	Owner.
Warrigal	1234	4	Chestnut ..	J. F. Lowien, Coalbank
Warwick Bachelor ..	1235	4	Brown ..	F. J. C. Martin, Kumbarilla
Warwick Lad ..	1124	3	Bay	G. A. Heise, Minden
Weir Wedge	1236	4	Brown ..	F. G. Searcy, Meandarra
Whiteflag	1125	3	Chestnut ..	R. Jackson, Munbilla
Zulu	1312	4	Black ..	F. A. Chardon, Mount Morgan
Unnamed (dead) ..	1208	3	Chestnut ..	A. A. Stokes, Abbotsford

PONY STALLIONS CERTIFICATED FOR THE YEAR 1936–37.

Name.	No.	Age.	Description.	Owner.
Ankor II.	1156	4	Dap. grey ..	W. Gilmore, Allora
Basra	1140	4	Bay	D. McDougall, Veresdale
Black Pride	1141	4	Brown ..	J. T. Collett, Pomona
Bonny Gem	1129	4	Bay	I. Ridge, Toowoomba
Boonah's Pride ..	1128	4	Black ..	G. E. Kirchner, Boonah
Cupid	1130	3	Bay	J. Duncan, Helidon
Darbie's Boy	1157	3	Grey ..	T. Hildred, Gladsfield
Darby	1380	4	Chestnut ..	Mrs. L. J. Mackaway, Goomeri
Essence of Fun ..	1131	3	Grey ..	I. Ridge, Toowoomba
Golden Laddie ..	1132	4	Chestnut ..	W. H. Strassburg, Lark Hill
Hope	1133	3	Bay	R. C. Draney, Laidley
Jacko	1158	3	Bay	N. T. Wright, Goondiwindi
Jimmy Boy	1237	4	Bay	P. T. Dwyer, Maclagan
Little Ken	1238	4	Black ..	J. C. Campbell, Haden
Little Sam	1381	4	Black ..	E. Althouse, Cloyna
Lord Ashwell ..	1159	3	Blue roan ..	C. Hensler, McLean street, Goondiwindi
Master Easmon ..	1386	4	Brown ..	W. Kelly, Ayr
Master Ludo	1216	3	Bay or brown	A. Kenyon, Eagle Farm
Migalo	1382	3	Bay	M. Daly, Gympie
Pilgrim	1134	3	Grey ..	D. D. Logan, Kilcoy
Pride of Allamby ..	1239	3	Bay or brown	H. P. Sperling, Crow's Nest
Ramadi	1135	4	Grey ..	I. Ridge, Toowoomba
Silver King II. ..	1136	4	Taffy.. ..	E. Grace, Maroon
Springmead Bright Fox	1209	3	Black ..	C. J. Cotter, Ipswich
Springmead Bright Lad	1221	4	Bay	Zeisemer Bros., Bongeen
Stibnite	1142	3	Iron grey ..	J. M. Newman, Caboolture

TROTTER STALLIONS CERTIFICATED FOR THE YEAR 1936–37.

Name.	No.	Age.	Description.	Owner.
Brisbane Chime ..	1151	4	Bay	B. Gooding, Southport
Chiming Derby ..	1220	3	Bay	S. H. Scells, Eveliegh street, Wooloowin
Cole Sound	1126	4	Bay	W. D. Dale, Rosewood
Derby Cole	1160	3	Bay	F. K. Weidman, Clifton
Direct Dean	1127	4	Bay	C. A. J. Tillack, Laidley

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1936–37.

Name.	No.	Age.	Description.	Owner.
Abbey Morn	1240	3	Brown ..	C. H. Frizzell, Southbrook
Adam	1082	4	Bay	J. McGrath, Moombra
Admiral Jack ..	1161	3	Bay	G. R. Shannon, Allora
Admiral Wallace ..	1162	3	Bay	P. J. Wilson, Elphinstone
Aerial Mail	1313	4	Bay	Camboon Pastoral Co., Camboon
Aldoman's Hope ..	1291	3	Bay	A. A. Brooks, Mackay
Arraglen	1322	4	Bay	Pownall and Pownall, Monto
Attraction	1323	4	Bay	R. T. Jones, Didcot
Bally	1241	3	Brown ..	G. Parton, Glenaven
Bally	1392	6	Bay	A. E. Carter, Home Hill
Barney	1324	3	Brown ..	T. Embrey, Kunioon
Baron Kerr	1083	3	Bay	J. Lehmann, Coolana
Baron Knight ..	1325	4	Bay	S. B. Scotney, Moorlands
Beau Laddie	1084	4	Bay	S. J. Draper, Woodford
Ben Attow	1388	3	Bay	W. D. White and Sons, Bluff Downs
Black Intent	1086	3	Black ..	D. Vogel, Boonah
Black Prince	1326	4	Brown ..	L. C. Walker, Bingera
Bold March	1327	3	Bay	L. Horne, Takura
Bold Noble	1328	5	Bay	W. T. Barrett, Bella Vale
Bonnie Intent ..	1329	4	Brown ..	W. Elsebach, Gayndah
Bonnie's Pride ..	1242	3	Bay	L. S. Gordon, Broxburn
Bonny	1314	3	Bay	R. W. Stirling, Theodore
Bonny Boy	1087	3	Bay	G. Erbacher, Harrisville
Bonny Shepperd ..	1287	3	Brown ..	W. Park, Toowoomba
British Abbot.. ..	1243	3	Brown ..	J. Sheedy, Yamsion
British King	1163	3	Bay	T. J. Ryan, Clinton Vale
British Prince ..	1330	4	Bay	C. F. Draheim, Murgon
British Royal ..	1212	3	Bay	Mrs. E. M. Craikie, Warwick
Burrendale George ..	1331	4	Bay	J. E. Stanton, Goomeri
Bute's Pride	1164	3	Chestnut ..	W. H. Hagenbach, Upper Freestone
Captain	1332	4	Bay	Mulcahy Bros., Nanango
Captain	1143	4	Bay	A. C. Andreassen, Tuchekoi
Captain Shepherd ..	1244	4	Brown ..	M. G. Polzin, Douglas
Captain Wallace ..	1088	4	Bay	W. E. Houston, Blackbutt

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1936-37—*continued.*

Name.	No.	Age.	Description.	Owner.
Captain Wallace ..	1333	3	Bay	A. Perrett, Kingaroy
Carlisle Boy	1165	3	Bay	J. H. McIvor, Emu Vale
Carlyle Boy	1245	4	Bay	W. Redman, Braemar
Carlyle Chief	1206	3	Bay	J. H. Lawson, Camp Mountain
Carlyle Pet	1246	4	Bay	A. R. Curd and Sons, Jandowae
Carlyle's Hero ..	1369	3	Bay	R. Maudsley, Murgon
Cedric	1247	4	Black ..	E. C. Stark, Crow's Nest
Clematic Flash Mac ..	1089	4	Brown ..	J. M. Newman, Caboolture
Clinker	1166	4	Bay	V. Osborne, Cobba-da-mana
Clyde's Pride	1389	4	Bay	W. D. White and Sons, Toowoomba
Cornish Laddie ..	1090	3	Bay	J. Evans, Helidon
Craig Hero	1248	3	Bay	Derrick Bros., Bell
Crest Vale Nobility ..	1167	3	Roan.. ..	A. Ritson, Clifton
Crystal Boy	1199	6	Brown ..	S. Webster, Kilcoy
Crystal King	1334	4	Black ..	J. B. Edwards and Sons, Kingaroy
Crystal Macbride ..	1249	3	Bay	Mrs. H. Kewley, The Gums
Culverthorpe Favourite Hero	1261	4	Brown ..	T. W. Caldicott, Yandilla
Culverthorpe High Opinion	1335	3	Bay	S. B. Trigger, Lakeside
Dale	1293	4	Bay	W. H. Gillham, Nebo
Dale Square	1250	4	Brown ..	B. McGovern, Greenmount
Dalkerk	1336	3	Bay	R. G. Allen, Wolca
Damsel's Lad ..	1091	4	Bay	W. C. Miller, Stanmore
Dark Chief	1252	3	Brown ..	M. Stower, Linthorpe
Darnley Boy	1168	3	Bay	W. R. Penrose, Beebo
Dayfield	1292	3	Chestnut ..	A. T. Wellby, Glenella
Dick Turpin	1169	3	Bay	W. J. Jones, Emu Vale
Dobin	1294	3	Brown ..	G. M. Myers, Nebo
Dolphus	1337	3	Brown ..	E. Reinbott, Kingaroy
Donald	1390	3	Light bay ..	W. H. Jackson, Ayr
Don of Cracow ..	1338	3	Bay	A. E. Gorrie, Childers
Dooling Major Lea ..	1201	4	Bay	R. Stokes, Collingwood, Victoria
Dragon	1197	4	Bay	G. S. Burns, Goondiwindi
Duke	1339	3	Bay	F. E. Chippendale, Bollier
Duke of Gloucester ..	1196	4	Bay	J. Little, Cobba-da-mana
Empston	1092	3	Black ..	T. Zellinskie, Lake Clarendon
Eureka Waller ..	1321	3	Chestnut ..	Central Queensland Meat Export Co., Lakes Creek
Fairval Gaiety's Best	1170	4	Bay	W. J. McKee, Clifton
Fairval Noble.. ..	1295	3	Bay	S. R. Whitehead, Kuttabul
Fairval Regal Gaiety..	1171	3	Bay	J. T. Scrymgeour, Warwick
Fairymead Baron Knight	1172	3	Bay	J. P. Warden, Goondiwindi
Fairymead Success ..	1340	3	Bay	Fairymead Sugar Co., Bundaberg
Farleton John ..	1391	4	Brown ..	A. P. Nelson, Charters Towers
Farmer's Pride ..	1093	3	Brown ..	R. Kucks, Wilson's Plains
Fashion's Prince ..	1173	3	Bay	T. J. Brosnan, Killarney
Favourite Blend ..	1203	3	Bay	A. A. Stokes, Abbotsford, Victoria
Gaiety Again	1174	3	Bay	W. P. Canning, Tannymorel
Gay Lad	1904	3	Bay	T. D. Gnech, Boonah
General Dale	1296	4	Brown ..	J. Martin, Mackay
General Douglas ..	1205	3	Bay	R. Stokes, Collingwood, Victoria
General Ker	1095	3	Bay	A. F. Schimke, Laidley
George Wallace ..	1176	4	Bay	T. J. Lyons, Clinton Vale
Gladfield	1341	4	Grey. ..	Apel Bros., Gayndah
Glasgow Clyde ..	1252	3	Bay	A. Kahler, Geham
Glenbar Royalist ..	1254	3	Bay	J. V. Willis, Meringandan
Glen Donald	1255	4	Bay	Ada Perina and Sons, Crow's Nest
Glen Lock	1342	3	Bay	W. T. Birt, Theebine
Glenroy	1297	4	Black ..	A. Parkinson, Finch Hatton
Glen Royal	1343	3	Black ..	J. P. Fortune, Kingaroy
Glen the Second ..	1253	4	Bay	J. Tennyson, Chinchilla
Gold Mount Prince ..	1256	3	Brown ..	C. Mesken, Maclagan
Gold Naught	1177	3	Chestnut ..	D. Sullivan, Allora
Grove King	1298	4	Bay	B. J. Langford, Finch Hatton
Haile Selassie ..	1299	4	Brown ..	N. Mackay, Mirani
Hero	1178	6	Brown ..	A. E. Charles, Inglewood
Hero	1344	3	Bay	B. T. and L. Balderson, Theebine
Intention	1179	3	Brown or black	J. Dwyer, Clifton
Intent Laddie ..	1345	4	Bay	H. Siefert, Crawford
Intent's Perfection ..	1180	3	Bay	J. Glasheen, Clifton
Intent's Pride ..	1393	4	Bay	H. B. Burstall, Ayr
Irish Chief	1181	4	Bay	J. Madigan, Dalveen
Jack	1144	4	Bay	J. Hose, Pomona
Jackson	1257	3	Bay	W. D. Kirstenfeldt, Kulpi
Jelbyn Jock	1300	4	Bay	Wright and Davidson, Nelbo
Johnnie Walker ..	1258	3	Bay	T. Gadsby, Woolabee Junction
Jondaryan Duke ..	1259	4	Bay	G. W. Hartmann, Bowenville
Jondaryan Worthy Minstrel	1397	4	Bay	W. J. Lloyd, Harrow
Jondaryan Worthy Sheriff	1260	4	Bay	Eva B. Armstrong, Toowoomba
Jumbo	1301	4	Bay	S. Micallef, Eton
Kelso Surprise ..	1210	3	Bay	A. Stokes, Abbotsford, Victoria
Kerlock	1096	4	Black ..	R. E. A. Schafferius, Gatton
Kerr Lad	1097	4	Bay	H. D. Reisenleiter, Mount Sylvia

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1936-37—*continued.*

Name.	No.	Age.	Description.	Owner.
Kerr Son	1098	3	Black	N. D. Dallinger, Mount Sylvia
Kerrston Again	1099	4	Black	P. Ryan, Viewlands
Kerrston Again	1081	3	Black	G. Elliott, Laidley South
Kerrston Delight	1100	3	Chestnut	W. M. E. P. Prufert, Laidley
Kerrston Lad	1101	4	Black	S. H. Hallas, Gatton
Kerrston's Viceroy	1346	4	Black	W. D. Porter, Kumbia
Kerwein	1102	3	Bay	H. Schultz, Lake Clarendon
Kimbar Mailboy Jack	1262	4	Bay	O. G. Ridge, Toowoomba
Kingdale	1182	4	Bay	W. Eastwell, Warwick
King David	1103	3	Black	J. Burnham, Forest Hill
King Wyllie	1104	4	Black	F. T. Harm, Plainland
Knight	1105	4	Black	A. O. Raddatz, Ingoldsby
Knight Abbit	1396	Aged	Brown	W. R. Buckholz, Bundaberg
Lad	1315	4	Black	H. Nightingale, Goovigen
Lehmann's Tenor	1263	3	Brown	Mrs. R. V. Breydon, Haden
Lincoln	1302	4	Brown	F. O. Schmidt, Eton
Lion	1347	4	Bay	W. Ellicomb, Mundubbera
Logan Prince	1145	3	Bay	W. W. Bell, Rathdowney
Lord Kerrston	1264	3	Black	J. R. Anderson, Southbrook
Mac	1394	4	Bay	W. Conley, Ayr
Macadair	1348	3	Bay	J. Bishop, Maidenwell
Mail Boy's Heir	1146	3	Bay	R. H. F. Graham, Beaudesert
Major	1349	3	Brown	T. Turner, Kingaroy
Major Lace	1350	4	Black	H. Seiler, Stuart River
Major Robin	1213	3	Bay	J. Kelvington, Glenore Grove
Major Wallace	1222	4	Bay	E. J. Breen, Eukey
Major Wyllie	1219	4	Bay	J. Summerville, Kholo
Marshall Gaiety	1106	3	Bay	C. A. Martens, Marburg
Marshall Mark	1303	4	Bay	F. J. Muller, Bowen
Marshall Ney	1304	3	Roan	M. R. Shannon, Nebo
Master Carlyle	1266	4	Bay	G. H. Bidstrup, Warra
Master Dale	1107	3	Bay	H. O. Neumann, Plainlands
Master Wallace	1183	4	Bay	T. O'Dempsey, Lower Freestone
Master Wallace	1351	3	Bay	G. E. Spratt, Nanango
Max	1352	4	Bay	S. Anderson, Tingoora
Max Pride	1265	4	Black	L. McGrath, Oakey
Mountain Lad	1316	4	Bay	E. A. Russell, Thangool
Mull Mull Benson	1200	4	Bay	R. Stokes, Collingwood, Victoria
Mull Mill Prince Ronald	1207	3	Bay	R. Stokes, Collingwood, Victoria
Nigger	1267	3	Black	C. Dunemann, Murra Murra
Noble	1108	3	Bay	F. Lawrence, Gilla
Noble	1305	3	Bay	A. F. Claussen, Mackay
Noble Hero	1268	4	Brown	E. Ehrlich, Murra Murra
Noble Lad	1184	5	Roan	W. J. Ryan, Kincora
Noble's Choice	1353	3	Bay	J. W. Horrobin, Tingoora
Oakbranch	1354	3	Brown	A. A. Dent, Gayndah
Pensfield Lad	1306	4	Bay	G. H. Ellis, Merinda
Peter Jackson	1269	4	Bay	Baker Bros., Pty., Ltd., Bowenville
Pinevale Mainmast	1270	4	Black	Jondaryan Estates, Jondaryan
Plucky Prince	1317	4	Bay	W. H. Davey, Baralaba
Pop's Pride	1271	3	Bay	K. R. Jasch, Pampas
Pride	1272	3	Bay	S. E. O'Brien, Jandowae East
Prince	1274	4	Brown	M. J. MacGinley, West Haldon
Prince	1307	4	Chestnut	A. J. Diecke, Proserpine
Prince	1273	3	Bay	H. Simmons, Yandilla
Prince	1185	3	Bay	S. G. Bremner, Yelbarbon
Prince Abbey	1275	3	Black	G. and H. Tews, Pittsworth
Prince Dale	1355	4	Bay	F. Rekow, Bundaberg
Prince Dale	1147	4	Bay	W. Rudd, Mudgeeraba
Prince Fabric	1175	5	Brown	R. A. Roylance, The Pocket
Prince Henry	1276	4	Bay	Bebbington Bros., Cambooya
Prince Rocket	1356	3	Bay	McCauley and Stewart, Mundubbera
Prince Roy	1277	4	Bay	P. G. Ruhle, Motley
Punch	1318	4	Bay	A. Thomasson, The Caves
Rare Champion	1109	4	Bay	H. O. A. Bartholomai, Boonah
Revenue	1118	5	Bay	P. Connole, Helidon
Robin	1308	4	Bay	D. S. Miller, Don River
Robin of Lilyvale	1215	4	Bay	J. P. O'Hagan, Belmont
Rob Roy	1278	3	Black	A. H. Geirke, Chinchilla
Rodney	1395	4	Roan	C. Brownson, Charters Towers
Ron	1357	3	Bay	Cribb Bros., Gayndah
Rose Farm Bold Kerrston	1110	3	Bay	J. W. Evans, Boonah
Royal	1358	4	Brown	J. A. Perkins, Mundubbera
Royal Banker	1186	4	Black	Hart Bros., Pilton
Royal Chief	1559	3	Chestnut	W. R. Lester, Monduran
Royal Dale	1279	3	Black	I. N. Kahler, Geham
Royal Intent	1187	3	Bay	H. J. Pacholke, Clifton
Royal Kerr	1111	3	Bay	E. H. Weier, Hatton Vale
Royal Lamington	1360	4	Black	A. Birch, Murgon
Royal Mac	1361	3	Bay	J. McDermid, Monto
Royal Prince II.	1280	3	Bay or brown	G. V. Hess, Kaimkillenbun
Royal's Bride	1189	3	Bay	E. Collins, Warwick
Royal Scot	1281	3	Brown	J. L. Strack, Helidon
Royal Top	1188	4	Bay	A. N. McKechnie, Fleurbaix
Sandy Kerlin	1214	3	Brown	J. H. Kelvington, Glenore Grove

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1936–37—*continued.*

Name.	No.	Age.	Description.	Owner.
Shamrock	1190	4	Bay	M. Bourke, Yangan
Sir Earl	1112	3	Bay	S. V. Carseldine, Linville
Sir Nolan	1148	3	Bay	P. V. Campbell, Lamington
Sir Walter Samson ..	1362	5	Brown ..	R. J. McKenzie, Wallaville
Sonny Boy	1320	4	Bay	S. A. Barrett, Thangool
Sterling Slade.. ..	1202	4	Black ..	F. Powell, Richmond
Studleigh Laddie ..	1113	4	Bay	W. H. Grans, Upper Tent Hill
Sudden Surprise ..	1282	4	Brown ..	L. F. Kuhl, Narko
Sydler	1309	3	Bay	J. L. Dalton, Walkerston
Talgai Hero	1283	3	Black ..	W. Freyling, Hodgson Vale
Talgai John	1191	3	Bay	H. Sprott, Talgai West
Talgai Model	1192	4	Bay	J. J. Rynne, Goomburra
Tarzan..	1114	3	Bay	Roderick Estate, Wilson's Plains
The Willow's Trustep	1193	4	Bay	A. M. Cadell, Texas
Toby	1364	5	Bay	T. Clark, Wietalaba
Toby	1149	3	Bay	J. Herron, Closeburn
Toby	1363	5	Roan.. ..	J. Malone, Sandy Creek
Trooper	1284	3	Bay	R. J. and L. V. Ole, Yarranlea
True Blue	1150	3	Grey	B. T. Smiles, Rathdowney
Ulupna Carl	1285	4	Bay	A. A. Treasure, Brigalow
Viron	1365	4	Bay	H. J. Rasmussen, Bundaberg
Wallace	1366	4	Bay	W. H. Lamke, Gundiah
Wallace Lad	1115	3	Bay	A. Muller, Mulgowie
Wickside Brilliant Son	1367	4	Bay	W. G. Currant, junr., Gunalda
Wildash Pride ..	1368	4	Black ..	W. J. Borchert, Murgon
Willowbank High Degree	1211	4	Black ..	J. Hamilton, Forest Hill
Worthy John ..	1194	4	Bay	W. A. Deacon, Allora
Worthy Lad	1116	3	Roan.. ..	P. Truloff, Minden
Yarradale Flash Marshall	1204	3	Brown ..	R. Stokes, Collingwood, Victoria
Young Douglas ..	1195	4	Bay	E. Costello, Thane
Young Kerrston ..	1117	3	Bay	B. O'Connor, Grantham
Young Ngapuna ..	1286	3	Bay	A. J. Harris, Yarranlea

REJECTED STALLIONS.

List of Stallions in respect of which Certificates of Registration were refused, on account of either lack of type and/or conformation, lack of size, or unsoundness during the year 1936-37. These horses are prohibited from service, either public or private:—

BLOOD STALLIONS REJECTED DURING 1936–37.

Name.	Age.	Description.	Reason for Rejection.	Owner.
David	Aged	Bay	L.T.	C. Mooney, Gin Gin
Julie Boy	3	Bay	L.T.	W. S. Forsyth, Gin Gin
Laddie Palms ..	4	Bay	Ost. and Curb	L. J. Russell, Thangool
Monarch	Aged	Brown ..	L.T. and Con.	J. G. Hollingsworth, Samford
Musician	Aged	Chestnut ..	L.T. and Con.	G. E. Archer, Charters Towers
Mutiara	5	Bay	Roarer ..	T. Addicott, Monto
Prince Henry ..	4	Bay	L.T. and Con.	G. Browne, Pittsworth
Rainbow	4	Piebald ..	L. Con. ..	W. Scantlebury, Theodore
Royal Bachelor ..	3	Bay	L.T. and Con.	J. A. Plant, Helidon
Sandy	5	Bay	Ringbone ..	T. B. Butterworth, Pindi Pindi
The Turk	3	Brown ..	L.T. and Con.	H. J. Watts, Yangan
Torpedo	6	Grey ..	L.T. and Con.	R. W. Brown, Kinkabilla
Westcott	3	Bay	L.T.	T. Toomey, Kingaroy
Young Mystic ..	Aged	Brown ..	Cataract ..	C. Myers, Nebo
..	5	Bay	L.T. and Con.	J. J. Johnston, Kerry
..	6	Bay	L.T. and Con.	J. T. Atkinson, Maryvale
..	5	Chestnut ..	L.T. and Con.	J. Waldron, Goondiwindi
..	4	Chestnut ..	L.T.	E. Diamond, Bundaberg
..	4	Chestnut ..	Spav. and Curb	E. Hopes, Rockhampton
..	6	Brown ..	L.T. and Con.	C. Quigley, Townsville

PONY STALLIONS REJECTED DURING 1936–37.

Name.	Age.	Description.	Reason for Rejection.	Owner.
Ace of Hearts	4	Brown	L. Con.	E. C. McNamee, Theodore
Black Feather	3	Brown	L.T.	G. Jones, Biggenden
Bright Laddie II.	4	Brown	Curb	V. C. Schelbach, Boonah
Darby Dean	Aged	Grey	L.T. and Con.	T. Walker, Maryvale
Don Pro	5	Bay	L.T.	J. Tinworth, Wondai
Teddie	Aged	Chestnut	L.T.	J. F. Leslie, Gympie
Welsh Boy	4	Bay	Ost.	G. Hart, Strathpine

TROTTER STALLION REJECTED DURING YEAR 1936–37.

Name.	Age.	Description.	Reason for Rejection.	Owner.
..	Aged	Bay	Ringbone	—. Schafter, Mackay

DRAUGHT STALLIONS REJECTED DURING YEAR 1936–37.

Name.	Age.	Description.	Reason for Rejection.	Owner.
Baron Rich	3	Bay	L.T. and Con.	W. Kapernick, Murgon
Baron's Chief	Aged	Black	L.T. and Con.	Mrs. E. H. Egan, Mount Tyson
Black Prince	4	Black	Sidebone	W. J. Prasser, Kulpi
Blaze	5	Bay	Sidebone	Carroll Bros., Kingaroy
Blue Prince	5	Brown	Spavin	S. C. Zahmel, Finch Hatton
Blutcher	4	Brown	Sidebone	J. E. Holland, Wycarbah
Bold Boy	6	Bay	Sidebone	L. A. Armstrong, Rosewood
Bolder	3	Bay	L.T. and Con.	D. J. Soden, junr., Mount Beppo
Bold Jock	5	Grey	L.T. and Con.	A. J. Kuss, Ropeley
Boom's Best	3	Bay	L.T.	F. Tucker, Kingaroy
Bounce	3	Bay	L.T.	W. H. O. Smith, Ceratodus
Bright Star	3	Bay	L.T.	R. S. McKenzie, Mount Perry
British King	4	Bay	L.T.	R. Kahler, Deep Creek
Bunny	4	Grey	Sidebone	R. M. Inslay, Bouldercombe
Captain	Aged	Chestnut	Size	G. L. Kelton, Dulacca
Charlie	4	Bay	L.T. and Con.	H. P. Opperman, Tamborine
Clan McDhu	5	Bay	L.T.	A. E. Gorrie, Childers
Clyde	5	Black	Sidebone	J. O'Leary, Leyburn
Crystal Son	Aged	Bay	Sidebone	A. S. Burdell, Bohle River
Diamond	Aged	Brown	L.T. and Con.	J. Guy, Ayr
Dodger	5	Brown	L.T. and Con.	C. V. Roberts, The Wallan
Don	Aged	Brown	Sidebone	B. Weekes, Bowen
Don	6	Bay	L.T. and Con.	W. J. Langton, Gilla
Donald's Pride	4	Black	L.T. and Con.	C. J. Hegarty, Clifton
Earl Marshall	5	Bay	Spavin	G. W. Orchard, Parapi
Evergreen Lad	3	Bay	L.T. and Con.	E. A. Munt, Maclagan
Exile	Aged	Black	Sidebone	W. Brazier, Jinghi Jinghi
Grand Master	5	Bay	L.T.	J. W. Betts, Kolan River South
Happy Charlie	3	Grey	L.T. and Con.	A. J. Rose, Chinchilla
Highfield Challenging	5	Bay	Bog Spavin	R. H. Applin, Biloela
Kenstar	5	Brown	Sidebone	J. Bridgeman, Cracow
Laddie	4	Bay	Sidebone	L. A. Ruhle, Motley
Lawrie	5	Bay	L.T.	R. Sommerfield, Tinana
Lorna's Pride	Aged	Bay	Sidebone	H. Bell, Toogoolawah
Major	6	Chestnut	Sidebone	H. Northdurft, Oakey
Major II.	3	Bay	L.T.	O. Horton, Kingaroy
Monte Carlo	4	Bay	Sidebone	T. C. Hoffman, Gladfield
Noble	5	Brown	Sidebone	W. E. Stark, Kingaroy
Noble	3	Bay	L.T.	G. Duffy, Neumgna
Noble	4	Bay	L.T.	Cowan Keys, Wondai
Olad	4	Bay	Thoropin	C. G. King, Goombungee
Pancho	3	Roan	L.T. and Con.	A. Erlandsen, Milmerran
Prince	5	Bay	L.T.	G. A. Elliott, junr., Dallarnil
Prince	4	Bay	L.T. and Con.	G. J. Austin, Crow's Nest
Prince Isles	5	Bay	L.T.	G. A. Steinhardt, Murgon
Prince Valley	5	Chestnut	Sidebone	Aplin Bros., Maroondan
Punch	5	Bay	L.T. and Con.	H. F. Scholoss, Dayboro'
Punch	3	Bay	L.T. and Con.	H. Webb, Reid River
Ravendale	6	Black	L.T. and Con.	W. Burgess, Laidley
Royal Wallace	4	Bay	Sidebone	N. G. Walker, Iveragh
Scottish Airs	4	Bay	Sidebone	V. C. Cutmore, Burndale
Shepherd's Robin	5	Bay	Sidebone	M. R. Shannon, Nebo
Sir Charles	5	Bay	Sidebone	V. C. Potter, Speedwell
Snip	5	Bay	Side and Spav	R. Stanbury, Proserpine
Special Mac	6	Bay	Sidebone	D. G. McIntosh, Goomeri
Standard	Aged	Skewbald	Sidebone	F. Kelly, Ayr
Stepford Belted Knight	6	Bay	Roarer	J. M. Hagenbach, Upper Freestone
Tarzen	3	Bay	L.T.	C. J. Zilkie, Bundaberg
The Sheriff	3	Brown	L.T. and Con.	A. Mutze, Umbiram
Toby	4	Bay	L.T. and Con.	H. McClymont, Oman-ama
Tom	6	Bay	L.T. and Con.	N. M. Watson, Ripley
Vanguard	4	Brown	L.T.	R. Briggs, Mount Perry
Willengie	Aged	Bay	L. Con.	W. J. Stanley, Cannon Valley
Worthy Carlisle	6	Bay	Sidebone	P. Truloff, Minden
Young Ivanhoe	5	Black	Sidebone	T. H. Oberhardt, Pittsworth
..	6	Bay	L.T. and Con.	W. G. Soper, Home Hill
..	3	Bay	L.T.	H. D. Giles, Biggenden
..	Aged	Brown	L. Con.	J. E. White, Rockhampton
..	Aged	Grey	L. Con.	S. Sammut, Alligator Creek
..	4	Bay	Sidebone	L. Jockheim, Longford Creek
..	3	Bay	Ringbone	J. Head, Mirani

AGRICULTURE ON THE AIR.

RADIO LECTURES ON RURAL SUBJECTS.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by Officers of the Department of Agriculture and Stock.

On Friday of each week, as from the 6th January, 1937, a fifteen minutes' talk, commencing at 12.45 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures until the 30th April, 1937.

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Friday, 8th January, 1937—"Humus and the Soil," by E. H. Gurney, Agricultural Chemist.

Friday, 15th January, 1937—"Citrus Orchard Practices," by R. L. Prest, Instructor in Fruit Culture.

Friday, 22nd January, 1937—"Looking Ahead—New Developments in Agriculture," by J. F. F. Reid, Editor of Publications.

Friday, 29th January, 1937—"Some Introduced Grasses—(1) Summer-growing varieties; (2) Winter varieties," by C. T. White, Government Botanist.

Friday, 5th February, 1937—"The Importance of Type in Queensland Merino Flocks," by J. L. Hodge, Instructor in Sheep and Wool.

Friday, 12th February, 1937—"Fat Lambs in Queensland," by J. L. Hodge, Instructor in Sheep and Wool.

Friday, 19th February, 1937—"Increase your Return from Eggs. How it can be done," by P. Rumball, Poultry Expert.

Friday, 26th February, 1937—"With the Flock in February. Points for the Poultry Farmer," by J. J. McLachlan, Poultry Inspector.

Friday, 5th March, 1937—"The Harvesting of Cotton," by R. W. Peters, Cotton Experimentalist.

Friday, 12th March, 1937—"Plant Nutrition," by E. H. Gurney, Agricultural Chemist.

Friday, 19th March, 1937—"Sheep Management under the Varying Conditions in Queensland," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 26th March, 1937—"The Care of the Flock," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 2nd April, 1937—"Winter Pastures," by C. W. Winders, Assistant (Agronomy).

Friday, 9th April, 1937—"Pork Products as Regular Items on the Menu," by E. J. Shelton, Senior Instructor in Pig Raising.

Friday, 16th April, 1937—"Some Poultry Farmers' Problems. What to Breed and How to Breed," by J. J. McLachlan, Poultry Inspector.

Friday, 23rd April, 1937—"Strawberry Planting and Other Seasonal Fruit Hints," by H. Barnes, Director of Fruit Culture.

Friday, 30th April, 1937—"Wheat Improvement in Queensland," by R. E. Soutter, Agricultural Research Officer.

NOTICE TO SUBSCRIBERS.

When renewing your subscription, write your full name plainly, preferably in block letters.

Address your renewal to the Under Secretary, Department of Agriculture and Stock, Brisbane.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of November, 1936 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Dot 5th of Oakvilla (238 days)	W. G. Marquardt, Springlands, Wondai	11,274·1	443·873	Victory of Greyleigh
Starlight II. of Oakvilla (227 days)	W. G. Marquardt, Springlands, Wondai	10,352·25	414·096	Victory of Greyleigh
Daisy 5th of Oakvilla (236 days)	W. G. Marquardt, Springlands, Wondai	9,704·65	381·447	Gussie
JUNIOR 3 (UNDER 3½ YEARS), STANDARD 270 LB.				
College Dinah	Queensland Agricultural High School and College	6,828·46	296·63	Duplex of Greyleigh
JERSEY.				
JUNIOR 4 (UNDER 4½ YEARS), STANDARD 310 LB.				
Trecarne Merle 4th	D. R. Hutton, Cunningham	7,001·46	395·579	Trecarne Golden King
SENIOR 2 (OVER 2½ YEARS), STANDARD 250 LB.				
Wyreene Chance	J. B. Keys, Gowrie Little Plain	5,898·25	313·609	Lyndhurst Majesty

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Specimens from the Lockyer Identified.

J.C., Project Club (Calvert)—

1. *Angophora intermedia* (apple tree). The apple tree is used as fodder in times of drought, but it is generally conceded that it is of little nutritive value.
2. *Crotalaria linifolia*, a small species of rattlepod.
3. *Gnaphalium japonicum* (cud weed).
4. *Eryngium rostratum* (Queensland eryngo).
5. *Boerhaavia diffusa* (tar vine). This plant is very widely distributed throughout Queensland both on the coast and inland. In the more inland parts of the State it is generally regarded as excellent fodder for stock.
6. *Alternanthera nana*. Species of Alternanthera are common weeds in the mixed native pasture and in cultivations in Queensland. They belong to the Amaranth family, and are quite wholesome.
7. *Sida* sp., probably *S. spicata*, a native weed allied to to *Sida retusa*.
8. This specimen is rather poor, but we should say it represents *Atriplex semibaccata*, the creeping salt bush or salt weed. It is generally regarded as quite good fodder.
9. *Modiola multifida* (button mallow).
10. *Eustrephus latifolius* var. *angustifolius*, a climbing plant of the lily family. The only name we have heard applied to it is native orange, due to the small orange red fruits which it bears.
11. *Neptunia gracilis* (the sensitive plant).
12. *Myoporum debile*.
13. There is a mixture here. The yellow flower belongs to a species of Goodenia, and the small, leafy stalk to a species of Phyllanthus. The specimens are too fragmentary for specific determination.
14. *Polygonum aviculare* (knot grass or knot weed). A very common weed in cultivations in Southern Queensland, particularly on the Darling Downs. It is not known to possess any harmful properties, although the long, running stems sometimes cause impaction.
15. *Celtis sinensis* (Chinese celtis). This is also commonly called the Portuguese elm, but it is not a native of Portugal, and this name belongs more particularly to *Celtisaustralis*. It is not very common, being seen occasionally in gardens and at a few places on the Darling Downs. The leaves are excellent fodder for stock.
16. *Swainsona* sp., a variety of Darling pea.
17. *Phaseolus lathyroides*. This is a leguminous plant, a native of tropical America, introduced into Queensland some years ago as a fodder. So far as our experience goes, however, stock do not take to it very readily. It is now a fairly common naturalised weed in many localities.
18. *Helichrysum ramosissimum*, a small native everlasting.

Cestrum Parqui. Poison Peach.

C.N.H. (Didcot)—

The specimen represents *Cestrum parqui* (the green cestrum), a native of Chili and the Argentine, now a naturalised weed in Queensland. It is poisonous to stock, and severe losses in South Queensland have been traced to it during recent years.

Poison peach is a different shrub (*Trema aspera*). In spite of its name this plant is often very freely eaten by stock without any ill effects following. At times, however, it develops a prussic acid-yielding glucoside, and if eaten heavily by hungry stock may cause death.

Beaudesert Plants Identified.

L.T. (Jimboomba)—

1. *Dodonæa viscosa* (hop bush). This is a small tree very common in Queensland both on the coast and inland. The leaves are used for fodder in times of drought, but it is not a particularly good fodder plant.
2. *Oxalis corniculata* (wood sorrel), a very common weed with an acid taste. It is sometimes mistaken for a legume.
3. *Lepidium ruderale* (bitter cress). This is one of the numerous weeds known in Queensland as mustard or turnip weed. It is quite a good fodder, but taints milk rather badly.
4. *Callistemon viminalis* (red bottle brush).
5. *Epaltes australis.*
6. *Hypericum gramineum* (St. John's wort).
7. *Phyllanthus thesioides.* This small plant is sometimes seen in the native mixed pasture. It is usually not very abundant in any one locality, and we have heard no local name given to it. So far as we know it possesses no particular properties of any interest, either useful or otherwise.
8. *Helichrysum ramosissimum,* a small native everlasting.
9. *Gnaphalium japonicum* (cud weed). Species of cud weed are very common in Queensland, both in pasture land and old cultivation paddocks. It is not known to possess any poisonous or harmful properties.
10. *Poranthera microphylla,* sometimes known as small poranthera.
11. *Jasminum suavissimum,* a native jasminth.
12. *Plantago lanceolata* (rib grass). This is not a true grass, but a member of the family Plantaginaceæ. In some countries it is regarded as quite good fodder, but in Queensland stock do not seem to take readily to it.
13. *Mallotus philippinensis* (Kamala tree). This is a very common tree in Queensland, and extends to India. The red, powdery substance surrounding the seeds is said to be used as a vermifuge.
14. *Galinsoga parviflora* (yellow weed). This is a common weed in cultivations in Queensland. It is generally regarded as quite good fodder for stock, particularly poultry.

Milky Cotton Bush. Tie Bush.

F.C. (Ormeau)—

1. *Asclepias curassavica* (red head or milky cotton bush), a native of tropical America, but now naturalised as a weed in most tropical and sub-tropical countries. It is quite common in Queensland, particularly along creeks and in gullies. It is poisonous to stock, but, generally, is not eaten by them in sufficient quantity to cause trouble.
2. *Wickstræmia indica,* commonly called tie bush on account of the fibrous nature of the bark. It is a native shrub very common in some localities and reputed to be poisonous to stock. Some years ago feeding experiments with this plant were carried out with leafy material at the Animal Health Station, Yeerongpilly, and after about a fortnight the heifers showed signs of emaciation and bloody scours, but recovered when put on ordinary food. A couple of years ago we received specimens of the berry of this plant from the vomit of a child which had died through eating a number of fruits of this plant. They are small, red, and succulent. A quntity were gathered and fed to guinea pigs at Yeerongpilly. The guinea pigs died in convulsions very shortly after feeding.

In the circumstances, the eradication of both these plants is recommended.

Daisy Bush.

J.E.L. (Monto)—

The specimens represent a species of daisy bush (*Olearia elliptica*), very common in some parts of Queensland, particularly as undergrowth or on the edge of some of our drier scrubs in the Burnett and Darling Downs districts. The plant is not known to possess any poisonous or harmful properties, but, as you suspect it, it might be as well for you to forward some samples as fresh as possible for the Agricultural Chemist to test for the formation of a prussic acid-yielding glucoside. The sample supplied is too dried and rather meagre for the purpose. About ½ lb. sent in as fresh as possible would be desirable.

Sudan Grass.

G.W.D. (Dalrymple Heights, Mackay)—

The Agricultural Chemist, Mr. Gurney, advises that Sudan grass does at times contain a prussic acid-yielding glucoside, but nothing to the same extent as the other sorghums, and usually it is quite free. In the circumstances, however, it is wise to use a little caution and not feed the grass in its young stage, nor allow empty cows to gorge themselves on it. It is also advisable to cut the grass and allow it to wilt before feeding. Sudan grass is essentially a summer fodder.

Blue Bush.

Inquirer (Yeerongpilly)—

Your specimen represents *Chenopodium auricomum*, blue bush. It is a native Chenopodium, sometimes called fat hen, although blue bush is the more common name applied to it. It is generally regarded as quite good fodder in the absence of better feed.

Johnson Grass. Knot Grass.

E.M. (Rathdowney)—

1. *Sorghum halepense*, Johnson grass. This grass is rather a pest in cultivation, as it spreads very rapidly. If any of its roots are cut up each little piece possessing an eye is capable of forming a new plant. The grass is often used for fodder, and stock seem to be rather fond of it, but, as with other members of the sorghum family, a certain amount of care should be exercised in feeding. Like other sorghums it contains a prussic acid-yielding glucoside.

2. *Polygonum aviculare*, knot grass or knot weed, a fairly common farm weed in South-Eastern Queensland, particularly on the Darling Downs and in the Lockyer and Fassifern districts. It is not known to be poisonous, but the long, stringy, fibrous stems may cause impaction if stock eat them to any extent.

CROWN LAND FOR GRAZING HOMESTEAD SELECTION.
ST. GEORGE DISTRICT.

38,625 acres of Sheep Land. Part of Mona expired Holding.

This land, being surveyed portion 4, parish of Dewurra, will be open for Grazing Homestead Selection at the Land Office, St. George, on Tuesday, 2nd February, 1937, for a term of lease of twenty-eight years and at an annual rental of ¾d. per acre during the first period of seven years.

The improvements on the land are provisionally valued at £388 and comprise fencing.

Special conditions will require the enclosing of the land with a fence which is both rabbit-proof and marsupial-proof during the first three years; the destruction of all prickly-pear during the first year and the ringbarking of 7,000 acres during the first seven years.

The land is watered both naturally and by bore drains, but further water will probably be required. The portion contains patches of belar, wilga, gidya, and mulga scrubs.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agent, St. George, and the Government Intelligence Bureaux, Sydney and Melbourne.

General Notes

Staff Changes and Appointments.

Messrs. E. H. Gurney, Agricultural Chemist, and W. T. Gettons, Accountant, of the Department of Agriculture and Stock, have been appointed to act temporarily as members of the Central Sugar Cane Prices Board at any time that Messrs. J. M. MacGibbon and A. R. Henry, respectively, may be prevented, through any cause, from attending a meeting of such Board.

Messrs. H. G. Gillan, Colonial Sugar Refining Co., Ltd., Victoria Mill, via Ingham, and J. J. Taylor, Emily street, Highgate Hill, have been appointed honorary rangers under the Animals and Birds Acts, and Mr. T. W. Hardcastle, Boonah, has been appointed an honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. J. A. Hennessy, Somerset Dam, via Esk, has been appointed an honorary ranger under the Animals and Birds Acts.

The appointment of Mr. W. H. Kirk, Auburn, via Chinchilla, as an honorary acting inspector of stock, has been cancelled.

Mr. N. Stubbings (Mundubbera) has been appointed an honorary ranger under the Animals and Birds Acts, and Messrs. W. Schneid (Mudgeeraba), A. Ludke (Nerang), H. Lee (Numinbah Road, via Nerang), and A. L. Sprenger (Mudgeeraba), patrolmen, Nerang Shire Council, have been appointed honorary rangers under the Native Plants Protection Act.

Mr. C. J. F. Swinburne, Durikai, has been appointed Instructor in Sheep and Wool, Department of Agriculture and Stock.

Messrs. G. H. Williams (Kureen), W. J. Sloan (Malanda), J. F. Britton (Malanda), R. T. Croker (Malanda), and W. C. Gordon (Kureen), have been appointed honorary rangers under the Animals and Birds Acts.

Messrs. A. J. Busuttin (Brampton Island, via Mackay), F. C. Wooster (Newry Island, via Kuttabul), and R. B. Jamieson (Proserpine), have been appointed honorary rangers under the Animals and Birds Acts and the Native Plants Protection Act.

"Filler" in Fertilizer.

A Regulation has been issued under "The Fertilizers Act of 1935" providing that the maximum weight and common name of any "filler" contained in any mechanically mixed fertilizer shall be declared on the label attached thereto.

Stanthorpe Fruit and Vegetables Levy.

Executive Council approval has been given, under the Fruit Marketing Organisation Acts, to an extension of the Stanthorpe fruit and vegetables general levy for a further period of twelve months, as from the 22nd December, 1936. This levy is payable by fruit and vegetable growers in the Granite Belt who consign their produce by rail or road in any one lot with a minimum of half a hundredweight and upwards. The amount of such levy is 3s. 4d. per ton, and a proportionate part of this amount is provided for each portion of a ton of fruit and/or vegetables.

Wild Life Preservation.

The recently declared National Park Reserve extending from Pioneer Point to Cape Conway, between Mackay and Proserpine, has been declared a sanctuary under the Animals and Birds Acts, and it will accordingly be an offence to take or kill any native animal or bird within the boundaries of this sanctuary.

Committee of Direction of Fruit Marketing.

Under the Regulations in force under the Fruit Marketing Organisation Acts, the various sectional group committees, with the exception of the "Other Fruits" sectional group committee, appoint two representatives to the Committee of Direction of Fruit Marketing.

An amendment of the Regulations has been approved, which will provide that the "other fruits" sectional group committee shall also have two representatives on the Committee of Direction, instead of one as formerly.

Commodity Board Ballots.

Certain regulations under the Primary Producers' Organisation and Marketing Acts, dealing with the conduct of ballots in connection with commodity boards have been rescinded, and fresh regulations issued in lieu thereof. The regulations, in their amended form, merely allow of certain slight alterations in the existing procedure, and provide that nominations in connection with pool board elections may be lodged with either the Returning Officer, or some person specified by the Minister. Again, ballot papers may be placed in a ballot box provided by the Returning Officer as well as forwarded through the post, as formerly.

Papaw Levy.

Approval has been given, under the Fruit Marketing Organisation Acts, to the extension, for a further twelve months, of the Papaw Levy Regulation. The extension will operate as from 2nd January.

Animals and Birds Sanctuary near Goomeri.

Tansey Reserve, Goomeri, has been declared a sanctuary for the protection of native birds and animals under "*The Animals and Birds Acts*, 1921 *to* 1924."

Central Sugar Cane Prices Board Election.

Following is the result of the election for Canegrowers' and Millowners' Representatives on the Central Sugar Cane Prices Board held on the 13th November, 1936:—

Canegrowers' Representative—	
Powell, T. A.	2,573
Holt, F. J. E.	977
Hudson, G. F.	923
Kirwan, P.	102
Informal	79
Millowners' Representative—	
Smith, E. S.	Returned unopposed

BOBBY CALVES.

In the last few years a trade has developed in veal, both for local consumption and for export. This trade has been of immense value to the dairy farmer, for in the past it has been the practice on many farms, where the carrying capacity is limited, to destroy all calves at birth. With the opening of this trade in bobby calves, the farmer has been able to obtain a return for what were previously useless calves.

Unfortunately, with some farmers, the practice is to send calves to the meatworks as soon as they are born, in what is really an immature condition. At one slaughtering establishment the total number of calves slaughtered in one year was 4,823, and of this number 538 were condemned as unfit for consumption, giving a condemnation of 11.11 per cent. This figure, obtained from a works situated in a farming district, is probably low for calves which must be trucked to works. The principal cause of these condemnations was immaturity. This loss could easily have been avoided by retaining the calf for ten days longer on the farm.

The milk of a newly-calved cow is fed to pigs and poultry, and is therefore not wasted, but it should be borne in mind that this milk would show a better return if fed to the new-born calf than if fed to pigs. The value of this milk is often not so much as a weight increaser as a preventer of weight loss. This is true of the larger breeds. With the smaller breeds its value is, of course, primarily for growth.

The law provides for a dressed weight of not less than 40 lb., and not less than fourteen days old.

Not only are condemned calves a direct loss to the farmer, but they involve the meatworks in loss, due to wasted labour in dressing, &c.

Mature veal is a wholesome food article, while immature veal, which has a laxative effect on the consumer, is not allowed on the market for consumption.

This loss, due to immature calves, can be avoided if the calf is fed for a few days on the milk of the freshly-calved cow. The calf should weigh 80 lb. or more live weight, before being sent to the meatworks. This live weight will give a dressed carcase of approximately 40 lb.

Rural Topics

Grading of Onions is Essential.

The quality of onions grown in Queensland is recognised by purchasers in the Southern States, the varieties of onions produced being of good flavour, stout and firm in texture, and capable of withstanding the stress of transport without serious bruising or other damage.

Buyers, however, have raised complaints because of onions being forwarded to market without due regard being given to the classification of the onions in accordance with the size of the bulbs. It is the custom of some growers to include large and small sized onions in the same bag. This practice is against the interests of the farmer, and is contrary to the wishes of the selling agents, and results in comparatively lower realisations on the market.

Farmers who have included onion growing in their cropping programme for the coming year are reminded that onions should be classified in acordance with their size. The small sized onions, say, below 2 inches in diameter, should represent one "size" grade. Onions ranging from 2 inches to less than 3 inches in diameter should comprise another grade, and onions from 3 inches to 4 inches in diameter should form a further grade.

Some growers prefer to classify the onions in grades in agreement with each ½-inch increase in diameter. This practice results in the onions in each grade being particularly even and uniform in appearance.

The number of grade classifications should be determined by the variation that occurs in the size of the individual bulbs comprising the crop. In ordinary circumstances, the classification of the bulbs into three or four grades will suffice. It is important, however, that the onions should be graded as evenly as practicable, and to effect the elimination of all "outsized" bulbs, especially the onions that are coarse, and are customarily referred to as "bull-necks."

The market prospects for 1937 are good, and no doubt the ultimate realisations will be governed very largely by the care that is taken by growers in placing the bulbs on the market in a manner conforming with the requirements of the trade.

As the defect complained if is purely of a mechanical nature, the remedy is comparatively simple, and capable of correction by any growers desiring to take suitable action.

Careless Branding of Stock.

Some stockowners exhibit great carelessness in branding their stock, cattle particularly. A visit to any of the large saleyards will reveal the slovenly use of branding irons. Not only are slipshop methods employed, but in some cases there is evidence of actual, but unintentional, cruelty. It is cruel to hold the hot iron on an animal until the skin is burnt through, and it is quite unnecessary. This practice may be due to underheated irons, but it may be due to over-hot irons held on the skin a fraction of a second too long, or with too much pressure. Such branding causes blotches, and very often the actual letters or figures are undecipherable. The skin in the area involved is urined for tanning purposes, and festering sores may result. Identification of the animal by means of such a brand is rendered very difficult, if not impossible.

It is a well-known fact that, on large stations, where thousands of calves are branded yearly, and where speed is a factor in the handling of large mobs, the standard of branding is much higher than on some small holdings, such as farms, where only two or three calves may be branded at irregular periods.

Good Grazing Depends on Control of Pastures.

Dairy farmers and stock raisers are advised to make a critical examination of their permanent pastures with an eye to the future of the most useful paddocks. In many instances the land-holder will find his pastures of paspalum, Rhodes grass, &c., to consist of a series of closely grazed patches interspersed with clumps comprised for the most part of dried stemmy grass which the stock will not touch. It is easy to visualise what will be the condition of these pastures during the coming spring. If the usual grazing methods are not improved upon the clumps which are useless now will remain neglected by stock, and will produce rank growth of no value for grazing. This means, of course, a very serious reduction in the total area of pasture actually grazed. The explanation of such uneven grazing lies in the preference shown by stock for short, leafy grass, which has a much higher feeding value than the same grass in a rank and stemmy condition, for when an animal is turned into a paddock which supplies a superabundance of feed it will graze the pasture in patches and will return again and again to these short patches, neglecting the overgrown clumps.

The first step in any plan designed with the object of keeping the whole of the grazing area in the short, leafy condition is to ensure adequate control of the pastures. This can be effected only by subdivision of large paddocks. While holdings of 160 acres continue to contain paddocks of 20 acres or more, so long will pasture be wasted as a direct consequence of insufficient control of the grazing areas. The extent of subdivision desirable depends upon the size of the herd or flock, upon the shape of the farm, upon the topography, upon the class of pasture, and so on. Consequently, no hard and fast rule can be laid down. The aim is to have each paddock small enough to permit of the producing stock grazing the pasture down evenly within a few days. Ten or twelve dairy cows concentrated on 1 acre of paspalum pasture about 6 inches tall will within a week have the pasture well down, so a farmer milking on an average sixty cows might have his better grazing area divided into a number of paddocks each 5 or 6 acres in extent. The number of paddocks should be six or more, as this will allow each paddock to be grazed for a few days when the grass is 5 or 6 inches high. Under favourable seasonal conditions, using six paddocks, the first grazed paddock should be ready for grazing again after the other five have been grazed in rotation. In most districts, however, there is great risk of sudden rainfall deficiency, and under these conditions nine or ten paddocks should be provided for rotational grazing purposes.

Amended Regulations of the Dairy Produce Acts.

Although a cooler type of dairy house has been prescribed by the new regulations governing production on the farm, every existing dairy house will not be condemned forthwith. If it is found to conform reasonably with requirements it will be passed, provided that the new method of ventilation is adopted. For instance—the new regulations provide for the use of wire-netting or ¼-inch woven wire for ventilation in place of the very closely-woven wire or gauze hitherto commonly used. All new buildings must comply with the new regulations.

Much inferior quality cream has been due to lack of cleansing equipment on the farm, and provision has been made for the installation of a hot water boiler, washing-up trough, and draining rack. For dairies using milking machines extra safeguards have been introduced in order to protect the milk from possible contamination where separating is done in rooms adjacent to the bails. Dairymen supplying milk to a cheese factory or for local consumption may be spared the expense of building what will be known as Dairy House A, but, instead, must provide a milk stand—a small enclosed platform three (3) feet from the ground. A cheaper building, known as Dairy House B, for washing and storing utensils must, however, be provided. A dairyman must use the buildings on his premises for the purposes prescribed, and must not allow stock within thirty (30) feet of a dairy house or milk stand. It will be necessary to provide a shelter shed to protect cream awaiting collection from the sun. No person shall collect cream from any other shed wthout the approval of a dairy inspector.

Cloths and receptacles must be used for cleansing the teats and udders of the cows at the bails at the time of milking, and cleansed thoroughly after each milking. Every person must be clean and wear clean clothes when milking and in the dairy. All milk provided for any purpose must be strained and cooled in an approved way. When milk or cream is kept in a dairy house, it must be pro-

tected from dust and insects and stirred every four (4) hours with a metal stirrer. Milk must be delivered to a cheese factory before 9 a.m. in the summer, and 9.30 a.m. in the winter.

The time by which the cleansing of the milking shed and utensils must be completed has been fixed. Cans returned from the factory must be scalded before being used again. All cans must be marked with a registered number allotted and the number of the can. It is illegal for any person to use a can owned by another person. Any conveyance used for the carriage of cream or milk shall comply with the regulations, and such conveyance shall be cleansed thoroughly after each time it is used. Milk being conveyed to a cheese factory must be covered, and any milk not so covered shall be rejected. A conveyance for the sale or delivery of milk has been prescribed, and provision has been made for the protection of protruding milk taps from dust by an approved cover.

Provision has been made to hold samples of cream for check testing at a factory. The owner of the factory must notify the supplier immediately any cream is below first grade or the prescribed standard of butter fat.

Milk delivered by every supplier to a cheese factory shall be tested not less than four times per month. The samples shall be held in numbered composite bottles and kept in a locked cupboard.

Every owner of dairy produce premises who prepares curd or casein shall provide a detached room constructed and used for the purposes prescribed. All skim milk to be used must be conveyed to the curd-preparing room in a manner approved, but any can used for cream or milk shall not be used for carrying the skim milk to the curd room. The whey must be removed from the room daily. The buildings, plant, and utensils must be kept in a clean and sanitary condition. Standards have been prescribed for the manufacture of cans.

Increasing Pineapple Yields by Closer Planting.

Pineapple plants are able to get along with relatively small quantities of water, provided the soil around their roots is kept moist. Since the pineapple is a shallow-rooting plant, this very desirable objective can be obtained by shading the soil around the bases of the plants. Reducing evaporation of soil moisture in this way is one of the chief advantages to be gained from the use of paper mulch. Where paper mulch is not available, or where its use is precluded for economic or other reasons, conservation of soil moisture in pineapple fields can be readily and efficiently effected by setting the plants closely together. It has been found from experiment that the shading of the soil, which is effected by the foliage of closely set plants, conserves almost as much moisture as the plants grown therein require for transpiration, indicating that the rate of water loss from the unshaded soil between the rows is greater than that from soil shaded by the plants. In the light of these considerations, it will be clear that pineapple yields can be markedly increased by increasing the number of plants per acre, provided always that such factors as sunlight, rainfall, and soil properties are favourable for the proper development of a greater plant population. It should be borne in mind, however, that increasing the number of plants per acre likewise increases the drain on the nutritional sources of the soil in which they are grown, and consequently correspondingly heavier applications of fertilizer are necessary.

A great deal of experimental work has been carried out in Hawaii to determine the best planting systems for pineapples. In general, it has been found that increasing the number of plants per acre tends towards a decrease in fruit size, but leads to marked increases in yields. Fruits from widely-spaced plants, while large in size, are prone to be irregular in shape, and they show an increased tendency towards multiple and fasciated tops, and to the incidence of such diseases as brown speck and fruitlet core rot.

From a consideration of all of the factors involved, it is recommended that on the sandy soils of the coastal areas pineapple plants should be set out at the rate of from 14,000 to 16,000 per acre, while for heavier soils at higher altitudes and for regions of relatively heavy rainfall a smaller plant population of from 10,000 to 11,000 per acre is likely to prove more satisfactory.

The rate of water loss from sandy soils in sunny localities is relatively high, and consequently closer planting is recommended, because of the increased need for shading the soil. For heavier, colder soils and for cloudy regions, however, a slightly wider spacing of the plants is desirable, in order that sunlight may penetrate between the leaves, so that drying of the soil after excessively wet periods is facilitated, and a soil temperature favourable to root development is maintained.

During recent years many different systems of plant spacing have been tried out, and while certain advantages may be claimed for three and four-row systems, under special conditions, it is now generally agreed that the double-row system affords most of the advantages of other systems with few of their drawbacks. Under this system, each plant can be conveniently weeded, fertilized, and harvested from the passage-way between the rows. Moreover, each plant is afforded uniform exposure, there being no "inside plants," as with three or four-row systems. In these latter systems, the plants of the inside rows are apt to suffer severely from shading by their stronger neighbours of the outside rows. While shading of the soil is desirable and distinctly beneficial, shading of the leaves is definitely harmful, as it may delay blossoming for twelve months, and inevitably leads to the production of small, late-maturing fuit of poor quality.

On second-cycle (replanted) fields, the spacing of double-row beds, centre to centre, should be about 5 feet 6 inches, with a 22-24-inch spacing between the two rows of each bed. This would leave a 3-feet 6-inch passage-way between the beds, which is of ample width for carrying out cultural, fertilizing, and harvesting operations. If the plants were spaced 1 foot apart in the rows, the number which could be set out per acre would be in excess of 15,000. By spacing the beds on 6-feet centres, as should be done on new land, but maintaining the same distances between the rows and between the plants in the rows, the number of plants required for an acre would be approximately 14,000. In wet or cloudy districts, the beds should be laid out on 6-feet centres, but while the spacing between the rows would remain the same as for sunnier areas, namely 22-24 inches, the distance between the plants should be increased to 18 inches. This would give a population of about 10,000 plants per acre. Proper spacing of plants in the rows can only be accomplished by the use of a cord or wire marked at the appropriate distances; in the absence of some such guide, the tendency is to plant at wider spacings than those intended, with the result that the number of plants per acre falls short of requirements.

Provided subsequent cultural and fertilizing operations are properly carried out, the yields which may be obtained from close planting systems greatly exceed those being secured from existing wide-centre systems. A first crop yield of approximately 50 tons per acre is theoretically possible from a population of 16,000 plants per acre; the fact that in excess of 40 tons per acre has been harvested from the first crop (plant crop) on a 400-acre field in Hawaii, planted at the rate of 16,000 plants per acre, clearly demonstrates the benefits of closer planting.

Lice and Mites in Pigs.

When pigs are seen frequently rubbing against convenient objects in their run, or when the skin is rough and scaly, particularly on the head, neck, and shoulders, skin parasites should be suspected.

Lice and mange mites are the common external parasites of the pig which cause the above symptoms. Lice measure up to about one-quarter of an inch in length, and as they occur on the skin surface are very readily seen. The mange mites, on the other hand, are extremely minute in size, being only about one-fiftieth of an inch long, and as they live under the skin surface the aid of the microscope is necessary to find them.

Both lice and mites cause considerable irritation, preventing the animal from making normal growth, and by lowering its vitality make it readily susceptible to other diseases. The mange mites cause the skin to become roughened, thickened, and thrown into folds, and unless their spread is controlled they are quite capable of causing death.

Parasitic mange is readily contagious, and all affected animals should be immediately isolated. After a thorough washing with warm soapy water, the animal should then be covered with crude oil, which is best applied by hand on a cloth. This disease may, when in an advanced stage, become very obstinate to treatment, and numerous applications of oil at frequent intervals may be necessary to effect a cure.

Crude oil is also very effective against lice, but as the first application does not kill the eggs, a second application should be made after an interval of fifteen days.

Pigs should be oiled in the evening, as exposure to the sun immediately after oiling, especially in white breeds, may cause blistering of the skin.

Where mange is suspected, scrapings from the affected areas should be taken. The scrapings should be made from the newer areas of infection, being sufficiently deep to cause the appearance of blood, and then forwarded in tightly-corked tubes to the Animal Health Station, Yeerongpilly.

Soil Conservation.

Soil conservation has within recent years become a problem of major importance to the various States of the Commonwealth, and it is satisfying to observe that a consciousness has been awakened in respect of soil drift in the arid areas of the Commonwealth and erosion in general in the various States.

Recently the Commonwealth Council for Scientific and Industrial Research appointed an officer to undertake preliminary investigations into the problem of soil drift, and this officer has just completed an initial survey of the north-eastern portion of South Australia and embodied his findings in a report issued by the Council for Scientific and Industrial Research. The effects of overstocking accentuated by climatic conditions have been stressed in the report, which emphasises the idea that although the problem is a botanical one the solution lies largely in the administrative field. The Commonwealth officer is now continuing his investigations in the south-western corner of Queensland, and is being assisted on the botanical side by the Government Botanist and the Walter and Eliza Hall Fellow in Economic Biology of the University of Queensland, who is accompanying the Commonwealth officer in the field. The Department of Agriculture and Stock is assisting in every possible way this investigation, which is of outstanding importance to the future of the arid areas of the Commonwealth. The results of the present investigation, which is based on an arrangement made between the Commonwealth Council and the Queensland Department of Agriculture and Stock, will be awaited with great interest.

Another problem—that of soil erosion, gullying, &c.—is also engaging the attention of the Department of Agriculture and Stock. Experiments are being initiated in certain parts of the coastal areas by an Experimentation Committee appointed by the Minister. The importance of this problem to the conservation of agricultural and orchard lands is fully realised. The Department is, further, maintaining contact with the investigations being carried out in other parts of the world, and notably with those of the Soil Conservation Service of the United States of America.

The Value of Strain in Pasture Plants.

Many of the cultivated pasture plants with which farmers and graziers are familiar are now grown in countries far removed from their original homes. Rhodes grass, for instance, is a native of Africa and which, within the last forty years, has been distributed to all other continents. It is only to be expected that, in course of time, the type developed in one particular area should differ in some respects from a type developed under different conditions of soil, climate, or management. In the case of Rhodes grass, for example, pastures raised from Queensland-grown seed are superior, even in Africa, to pastures developed from African seed. As a matter of fact, large quantities of Queensland seed of Rhodes grass are annually exported to Africa. These different types are known as ''strains.''

What is true of Rhodes grass applies also in varying degrees to many other grasses and clovers, as well as to lucerne. In a number of countries which are well advanced in pasture research (for example, New Zealand and Great Britain) a great deal of attention has been paid to the differences in pastures developed from various lines of seed. Commercial and other lines of seed of the locally important species have been collected from many local and foreign sources, tested against one another under field conditions, and the lines producing the best pastures traced back to their respective origins.

Such trials on recognised testing stations have resulted in the seed market being supplied with lines of seed certified by responsible authorities to be superior for sowing purposes to certain other lines. Thus we have New Zealand Government certified perennial ryegrass, cocksfoot, and white clover seeds, &c. In some instances the preliminary testing station trials have been dispensed with, and certification accorded seeds from pastures known to be long-lived. New South Wales Government certified seed of *Phalaris tuberosa* is of this nature.

None of the grasses embraced in the seed certification schemes of other States and countries is as yet grown for seed purposes in Queensland; consequently the activities of the Queensland Department of Agriculture and Stock have been directed towards the testing of certified strains from other regions against one another and against uncertified strains. This work has revealed the following seeds to be very suitable for local use:—

Perennial Ryegrass—New Zealand Government certified permanent pasture.

Cocksfoot—New Zealand Government certified Akaroa.

Phalaris tuberosa—New South Wales Government certified.

White Clover—New Zealand Government certified.

Orchard Notes

FEBRUARY.

THE COASTAL DISTRICTS.

FEBRUARY in coastal Queensland is frequently a wet month, and, as the air is often heavy with moisture and very oppressive, plant growth of all kinds is rampant, and orchards and plantations are apt to get somewhat out of hand. Where green cropping is not practised it is not always possible to keep weed growth in check by means of cultivation. At the same time, the excessive growth of weeds provides a large quantity of organic matter which, when it rots, tends to keep up the supply of humus in the soil, so that, although the property looks unkept, the fruit-producing trees and plants are not suffering, and the land is eventually benefited. When the weed growth is excessive and there is a danger of the weeds seeding, it is a good plan to cut down the growth with a fern hook or brush scythe and allow it to remain on the ground and rot, as it will thereby prevent the soil from washing, and when the land is worked by horse power or chipped by hand it will be turned into the soil. This is about the most satisfactory way of dealing with excessive weed growth, especially in banana plantations, many of which are worked entirely by hand.

The main crop of smooth-leaf pineapples will be ready for canning, and great care must be taken to see that the fruit is sent from the plantation to the cannery with the least possible delay and in the best possible condition. The only way in which the canners can build up a reputation for Queensland canned pineapples is for them to turn out nothing but a high-class article. To do this they must have good fruit, fresh, and in the best of condition.

Bananas for shipment to the Southern States should on no account be allowed to become over-ripe before the bunches are cut; at the same time, the individual fruit should be well-filled and not partly developed. If the fruit is over-ripe it will not carry well, and is apt to reach its destination in an unsaleable condition.

Citrus orchards require careful attention, as there is frequently a heavy growth of water shoots, especially in trees that have recently been thinned out, and these must be removed. Citrus trees can be planted now where the land has been properly prepared, and it is also a good time to plant most kinds of tropical fruit trees, as they transplant well at this period of the year.

A few late grapes and mangoes will ripen during the month, and, in respect to the latter, it is very important to see no fly-infested fruit is allowed to lie on the ground but that it is gathered regularly and destroyed.

Strawberries may be planted towards the end of the month, and, if early ripening fruit is desired, care must be taken to select the first runners from the parent plants, as these will fruit quicker than those formed later. The land for strawberries should be brought into a state of thorough tilth by being well and deeply worked. If available, a good dressing of well-rooted farmyard manure should be given, as well as a complete commercial fertilizer, as strawberries require plenty of food and pay well for extra care and attention.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE marketing of later varieties of peaches and plums and of mid-season varieties of apples and pears, as well as of table grapes, will fully occupy the attention of fruitgrowers in the Granite Belt, and the advice in these notes for the two previous months with regard to handling, grading, packing, and marketing is again emphasised, as it is very bad policy to go to all the trouble of growing fruit and then, when it is ready to market, not to put it up in a way that will attract buyers.

Extra trouble taken with fruit pays every time. Good fruit, evenly graded and honestly packed, will sell when ungraded and badly packed fruit is a drug on the market. Expenses connected with the marketing of fruit are now so high, owing to the increased cost of cases, freight, and selling charges, that it is folly to attempt to market rubbish.

During the early part of the month it will be necessary to keep a careful watch on the crop of late apples in order to see that they are not attacked by codling moth. If there is a slightest indication of danger, a further spraying will be necessary, as the fruit that has previously escaped injury is usually that which suffers the most.

Fruit fly must also be systematically fought wherever and whenever found, and no infested fruit must be allowed to lie about on the ground.

Grapes will be ready for market, and in the case of this fruit the greatest care in handling and packing is necessary. The fruit should never be packed wet, and, if possible, it is an excellent plan to let the stems wilt for a day at least before packing. This tends to tighten the hold of the individual berries on the stem and thus prevent their falling off.

In the western districts winemaking will be in progress. Here again care is necessary, as the better the condition in which the fruit can be brought to the press the better the prospect of producing a high-class wine.

Where necessary and possible citrus trees should be given a good irrigation, as this will carry on the fruit till maturity, provided it is followed up by systematic cultivation so as to retain a sufficient supply of moisture in the soil.

ECONOMY IN DAIRY PRODUCTION.

A measure of economy which involves the dairy farmer in very little extra work is to increase production by systematic herd testing and culling, and breeding only from the best producers.

Far too many herds include cows whose production falls far below average, and the dairy would be run far more economically if these cows were fattened for the butcher. They belong to the "boarder" class, and usually consume more fodder than a heavy producer. Too many animals of this class impair the efficiency of the farm.

No matter how close a watch is kept, it is almost impossible to pick the lowest producers without systematic testing over the whole lactation period. If the farmer is prepared to do this himself well and good, but he requires to have an accurate knowledge of testing and the principles involved in calculating results.

The Department of Agriculture and Stock offers a herd-testing service which involves the dairyman in no monetary expenditure whatsoever. In other States and countries up to 6s. per cow is paid for a similar service. Surely it is impossible to believe that dairy farmers in other parts pay for something that is valueless.

In Queensland many dairymen have availed themselves of the services offered, and the results achieved by those who have tested and culled over a number of years have proved that it is well worth while. Nevertheless, there are very many more who could do so to their own advantage.

To obtain this service it is only necessary to make application to the Department. Sample bottles in a box are sent to the farmer, and all he has to do is to weigh each cow's milk and place a sample in a bottle, as directed. Then, if the factory he supplies is co-operating with the Department, he forwards the box of bottles containing the samples to that factory. Otherwise he may send his samples direct to the Department of Agriculture and Stock, which pays the rail freight.

The testing is done five times at intervals of, approximately, sixty days, and at the end of the period the farmer receives a complete return showing the relative value of each cow under test. It must be remembered that the object of testing is not so much to find out the best cows in the herd as to find out the worst and least profitable.

Testing is only half the job, and the Department depends on the good sense of the farmer to see that he does not keep feeding unprofitable cows indefinitely. Testing is of no value in raising the standard of production of the herd unless the low producers are culled regularly.

It is a poor farm that cannot afford to dispose of the two least profitable cows each year. Remember the first loss is the least. The longer the "boarders" are kept the more expensive they become. They eat the feed of a good milker and much time is wasted, frequently, in rearing their calves, which turn out no better producers than the dams.

Farm Notes

FEBRUARY.

REFERENCE was made in last month's Notes to the necessity for early preparation of the soil for winter cereals, and to the adoption of a system of thorough cultivation in order to retain moisture in the subsoil for the use of crops intended to be raised during the season. The importance of the subject, and its bearing in relation to prospective crop yields, is made the excuse for this reiteration.

Special attention should be given to increasing the area under lucerne (broad-leaf Hunter River) wherever this valuable crop will grow. Its permanent nature warrants the preparation of a thorough tilth and seed-bed, and the cleansing of the land, prior to sowing the seed, of all foreign growths likely to interfere with the establishment and progress of the crop. Late in March or early in April is a seasonable period to make the first sowing providing all things are favourable to a good germinatior of seed.

Dairymen would be well advised to practise the raising of a continuity of fodder crops to meet the natural periods of grass shortage, and to keep up supplies of succulent fodder to maintain their milch cows in a state of production.

Many summer and autumn growing crops can still be planted for fodder and ensilage purposes. February also marks an important period as far as winter fodder crops are concerned, as the first sowings of both skinless and cape barley may be made at the latter end of the month in cool districts. Quick-growing crops of the former description, suitable for coastal districts and localities where early frosts are not expected, are Sudan grass, Japanese and French millet, white panicum, liberty millet, and similar kinds belonging to the Setaria family. Catch crops of Japanese and liberty millet may also be sown early in the month in cooler parts of the State, but the risk of early frosts has to be taken.

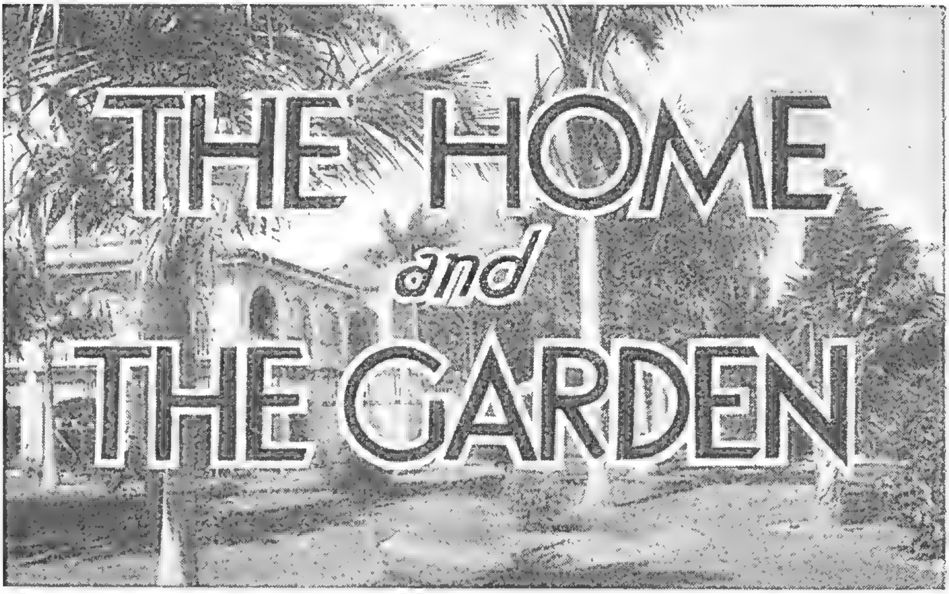
Maize and sorghums can still be planted as fodder and ensilage crops in coastal districts. In both coastal and inland areas, where dependence is placed largely on a bulky crop for cutting and feeding to milch cows in May and June, attention should be given to Planters' Friend (so-called Imphee) and saccaline.

In most agricultural districts where two distinct planting seasons prevail, the present month is an excellent time for putting in potatoes. This crop responds to good treatment, and best results are obtainable on soils which have been previously well prepared. The selection of good "seed" and its treatment against the possible presence of spores of fungoid diseases is imperative. For this purpose a solution of 1 pint of formalin (40 per cent. strength) to 24 gallons of water should be made up, and the potatoes immersed for one hour immediately prior to planting the tubers. Bags and containers of all kinds should also be treated, as an additional precaution. "Irish Blight" has wrought havoc at times in some districts, and can only be checked by adopting preventive measures and spraying the crops soon after the plants appear above the ground. Full particulars on the preparation of suitable mixtures for this purpose are obtainable on application to the Department of Agriculture, Brisbane.

Weeds of all kinds, which started into life under the recent favourable growing conditions, should be kept in check amongst growing crops; otherwise yields are likely to be seriously discounted. The younger the weeds the easier they are to destroy. Maize and other "hoed" crops will benefit by systematic cultivation. Where they are advanced, and the root system well developed, the cultivation should be as shallow as possible consistent with the work of weed destruction.

First sowings may now be made of swede and other field turnips. Drilling is preferable to broadcasting, so as to admit of horse-hoe cultivation between the drills, and the thinning out of the plants to suitable distances to allow for unrestricted development. Turnips respond to the application of superphosphate; 2 cwt. per acre is a fair average quantity to use when applied direct to the drills.

Where pig-raising is practised, land should be well manured and put into good tilth in anticipation of sowing rape, swedes, mangels, field cabbage, and field peas during March, April, and May.



OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

HOLIDAY TRAVELLING.

Travelling with a baby and several small children is no holiday for their mother. Unless she plans everything carefully beforehand, a long train journey may end with an exhausted mother and a handful of cross, tired, over-fed children, who will be sick for the next few days. Perhaps a little advice at this season of the year may be helpful.

Food.

It is most important that this should be carefully considered beforehand. The breast-fed baby who has been properly managed should give no trouble at all. But it is not so with the bottle-fed infant. We have seen many who have been seriously upset by milk which has gone bad in the train, especially in hot weather. It is true that there are ways of carrying the baby's milk safely. But these require so much care and understanding, and the consequences of any mistake may be so serious, that we cannot advise them. Nor can we advise the mother on a journey to buy milk at the railway stations. Much the safest plan is to carry a supply of good dried milk (Glaxo or Lactogen)—not, of course, dried skimmed milk. Boiling water is always procurable, and it may also be carried in vacuum flasks, so that it is always possible to scald the bottles and teats, and to make up the feeds for each meal. Any milk left after a feed should be thrown out at once—never left in the bottle. It is well to carry more than one bottle and teat. These should be wrapped in clean boiled butter muslin and carefully packed in a tin. Though the baby may not be used to dried milk, it will do him no harm, provided it is not made too strong. It will be wise to make it up rather weaker than advised on the tin. At

the end of the journey, when good fresh milk is procurable, he will soon make up for having been on a rather weak mixture for one or two days.

For the toddler avoid bought foods, cakes, and sweets, which may do him much harm especially as the novelty and excitement will very probably have weakened his digestion. Remember that a day of rather short rations will do him no harm but a day of over-feeding may go a long way to spoil his holiday and your own too! Carry your own provisions. Pack a tin with some slices of baked bread and oatcake, which may be ready buttered, and some sandwiches, preferably of wholemeal or cerevite bread. These may contain lettuce, sliced tomatoes, egg, either sliced or scrambled, or soft cheese spread on butter, or marmite. Add a few dates or seedless raisins, apples or oranges, and you have all the solid food necessary. He may drink dried milk dissolved in hot water, like his baby brother, or you may carry one or two lemons with a small packet of sugar, which will make a drink he will surely relish. Let him have his little picnics at the right times, but don't try to keep him quiet by feeding him all the time. You won't succeed; it will only make him cross and irritable, miserable himself, and a torment to others. But let him have a drink of water when he wants it.

Amusement.

Most children will be interested in looking out of the window until they are tired, but don't let them tumble out. It may be well to carry a few simple toys and picture books and writing pad and a pencil.

Clothing.

You won't need to carry much wraps in the summer, but a light rug and cushion will be useful. For the baby have a plentiful supply of napkins, and some old newspapers or a mackintosh bag for the wet napkins.

Rest and Sleep.

These are important if over-fatigue and fretfulness are to be avoided. A dress-basket is most useful for a young baby. Properly managed, he will sleep or lie awake in this quite contented, and much happier than if constantly nursed in the arms of an over-heated and exhausted mother.

If you have trained your children well, you will reap your reward when travelling. How sad it is to see children in the train scrambling over everything, eating an endless supply of cakes and sweets, grubby and tired, ignoring their mother's efforts at control, and finally fretful and crying from sheer exhaustion and discomfort!

IN THE FARM KITCHEN.

VALUE OF ORANGES AND MANDARINS.

Oranges and mandarins are not acid-forming. On the contrary, they are alkaline in reaction and serve to balance the recognised staple foods which are acid-forming and which, if used too freely, result in acidosis, a forerunner of many common ailments which often lead to dangerous disorders. Medical opinion on their value is quoted as follows:—

Sir William Arbuthnot Lane, Bart, C.B., M.S., F.R.C.S., etc. (England):—

"An orange is a perfect beginning to a meal. The minimum amount daily to prevent scurvy is one ounce of orange juice."

W. D. Sansum, M.A., M.D. (America):—

> "Oranges have an alkaline reaction in the blood which offsets the acidity caused by such good foods as meat, fish, eggs, cereals, and bread."

In a questionnaire sent to 118 child specialists by the California Fruit Growers' Exchange, asking what fruits they recommend most often for children under three years of age, 93 out of the 107 who replied simply wrote "oranges." Some of the reasons they gave for this choice were:—

> Orange juice is easily digested. Its salts and acids form the best natural mild laxative that physicians know. It is a preventive of children's disorders due to sterile or deficient food. It has a naturally corrective medicinal diet; and, not to be overlooked, all children like oranges. Orange juice helps to build up a sound, healthy bone-and-muscle structure, and gives the body the right start.
>
> It is particularly helpful in building good tooth structure. Aside from its regularity benefits, orange juice supplies a necessary element to growth—vitamins.

The value of orange juice is stressed in all advice given with regard to the feeding of babies, beginning with a teaspoon a day diluted with an equal quantity of water, as early as the sixth week. For the artificially fed baby, orange juice is of even greater importance.

The value of oranges and mandarins may be summarised:—

1. Being rich in vitamin A, they help to resist infection of the eye, nose, and throat.

2. Rich in vitamin B, they promote growth and are consequently particularly valuable for young children.

3. They offer an abundant supply of the antiscorbutic vitamin C, the food factor most likely to be wanting in the ordinary diet, and the lack of which is often the cause of scurvy, retarded growth, malnutrition in children, bone and growth development, anæmia, &c.

4. They are alkaline in reaction and prevent acidosis.

5. They stimulate the appetite.

6. They are mildly laxative.

7. They contribute to the diet potash, calcium, phosphate, and iron.

8. They aid digestion.

9. They contain a large percentage of natural fruit sugar which provides energising food value in an easily assimilated form.

The above are nine excellent reasons for the inclusion of oranges and mandarins in the daily diet. The tenth, and from a family point of view, not the least important, is the deliciousness of the fruit itself.

What youngster does not appreciate mandarins, and how ideal and hygienic are these for inclusion in school lunches.

Oranges and mandarins will often tempt the appetite of the sick and convalescent when other foods fail to appeal.

Remember, the body cannot store some of the health factors required by it, and it is necessary to replace them at frequent intervals. Therefore, during the season buy oranges and mandarins freely so that old and young alike can have them daily.

Schools or consumers not in close touch with retailers will, on application to the Committee of Direction, be supplied with a list of growers prepared to forward oranges and mandarins direct to country customers.

Besides being ideal for eating fresh, oranges and mandarins may be used for household purposes in a multiplicity of ways, e.g.:—

Orange Delight.

Take 5 oranges, 1 teacupful of white sugar, 1 pint milk, 3 eggs, 1 tablespoonful of cornflour. Peel the oranges, cut. Heat the milk by letting it steam in a saucepan of boiling water, add the cornflour, mixed smooth with a little milk, and the well-beaten eggs. Sweeten, stir till thick, pour over the oranges, and beat ½ pint cream. Sweeten, flavour with orange juice and a little grated rind piled on top of the custard, then into slices, removing the pips, and sift sugar over them.

Jellied Oranges Cut in Sections.

Remove a piece 1 inch in diameter from the navel ends of oranges. Remove juice and pulp with a teaspoon, and strain through cheese cloth. With first two fingers take out as much as possible of the white inner membrane from the orange skin. Use juice to make orange jelly, and fill orange skins. Place in upright position in a pan of crushed ice and leave until firm. Cut in halves, then in thirds, and serve with or without whipped cream.

Orange Snow.

Dissolve an ounce of isinglass in a pint of boiling water, strain and let it stand till nearly cold. Mix it with the juice of 6 or 7 oranges and 1 lemon, add the white of 3 eggs, and sugar to taste, whisk all together until like a sponge, put into a mould and turn out the following day.

Orange Roly-Poly.

Two cups flour, 4 teaspoons baking powder, 1 teaspoon salt, 4 tablespoons butter, ¾ cup milk, ½ cup sugar, 4 oranges, grated rind 1 orange, ½ cup water.

Mix and sift flour, baking powder, and salt. With tips of fingers rub in two tablespoons butter, and mix to a dough with milk. Roll out one-half inch thick, and cover with small pieces of orange pulp. Mix sugar, orange rind, and remaining butter, and sprinkle two-thirds of it over the orange. Roll up; pinch ends together; place in baking dish; sprinkle with remaining sugar, surround with water, and bake about thirty minutes. Serve with an orange or lemon sauce.

Creamy Pudding Sauce.

1 egg, ¾ cup powdered sugar, 1 cup cream, 2 tablespoons orange juice, 1 tablespoon lemon juice.

Beat egg until light; beat in powdered sugar. Add cream, whipped until stiff, and fruit juices.

Orange Cream Custard.

Four oranges, 2 eggs, ½ cup sugar, 2 teaspoons flour, ⅛ teaspoon salt, 2 cups milk, ½ teaspoon vanilla, 5 tablespoons sugar.

Beat egg yolks, add one-quarter cup sugar, flour and salt, and mix thoroughly. Add milk and cook in double boiler until thick enough to coat spoon. Cool, add vanilla, and turn into serving dish containing peeled and sliced oranges. Beat egg whites with five tablespoons sugar. Heap on top of custard and serve.

Orange Fritters.

Peel and core the oranges, cut in slices, roll in sugar, dip in batter and fry.

Batter for the above:—Two eggs, 2 tablespoonfuls flour and a little milk. Mix thoroughly and smoothly before dipping the orange slices in. Other fruit may be used in the same way.

Tangerine Delight.

Two cups of pure crystal sugar, 1 cup strained orange juice, 3 dessertspoonfuls powdered gelatine, 1 dessertspoonful vanilla. Bring orange juice to boiling point, pour over the sugar and gelatine, mix well. When cool add essence and beat for 12 minutes very quickly. Set in a buttered tin. When firm cut in blocks and roll in icing sugar.

Orange and Passion Fruit Snow.

Two dessertspoons gelatine, 1 cup orange and passion fruit juice, ½ cup hot water, ½ cup cold water, 3 tablespoons sugar, 1 egg white beaten stiff.

Dissolve gelatine and sugar in hot water, add cold water and fruit juice (add more sugar if necessary.) Leave until thickened, beat with an egg whisk until thick, gradually add egg white and beat until the mixture holds its shape.

Orange Cake.

4 eggs, 8 oz. flour, 8 oz. sugar, 7 oz. butter, juice and rind of two oranges, 3 tablespoons milk, 1 teaspoon good baking powder.

Cream butter and half sugar, add the other half of sugar to eggs. Beat eggs and sugar until spongy, then add to the butter. Mix very lightly, add juice and rinds. Sift flour, with baking powder, and add milk, mix well and bake in moderate oven for 1 hour. (Or bake in sandwich tins.) Ice when cold.

Fruit Sponge.

Juice of two oranges, 1 lemon, 6 passion fruit, 1 cup sugar, 1 heaped tablespoon powdered gelatine, 1 tablespoon flour, 2 cups water.

Mix flour with a little water, dissolve gelatine in half cup water, put all ingredients except passion fruit in a saucepan and bring to boil. When nearly cold beat until nearly stiff, then add passion fruit and put in mould; serve with cream.

Mandarin Cake.

1 lb. flour, ½ lb. butter, ¾ lb. sugar, 3 eggs, 1 cup milk, 2 teaspoons baking powder, 1 teaspoon salt, 2 mandarins.

Beat butter and sugar to cream, add eggs one by one and beat each well as it goes into the mixture. Sift flour, baking powder, and salt, mix with butter and eggs alternately with the milk. Grate the rind of the mandarins and put into the mixture. Put into tin and bake about an hour and quarter. Ice with ¾ lb. icing sugar mixed with 3 tablespoons mandarin juice and just warmed over fire.

Mandarin Filling.

One mandarin, 1 tablespoon cornflour, ½ pint water, 2 oz. butter, 2 oz. sugar.

Put water and butter on to boil, stir in moistened cornflour, add sugar, and stir till thickened, add grated rind and juice of mandarin, cool, and put between sandwich.

PAPAW RECIPES.

Papaw Preserve.

Take 1 lb. of sugar, ½ pint of water, to make a syrup, 2 tablespoonfuls of lime, and a gallon water. Put the lime into the water, and stir until dissolved; peel the fruit, and cut into slices about 2 inches thick and the length of the fruit. Put these pieces into the lime water and allow to remain for about 8 to 10 hours; then take the fruit out, make the syrup, and when boiling put in the papaw; boil quickly for half an hour; take out the fruit and arrange lengthwise in a glass jar. When the syrup is cool, fill the jar and cork down tightly.

Fruit Salad.

Take as many different fruits as possible—oranges, papaws, pineapples, apples, bananas, passion fruit, and the juice of a lemon. Cut bananas into thin slices, and papaws and pineapples into cubes, peel the apples and slice them in. Remove pith from oranges and slice them in. Sprinkle each alternate layer with sugar, squeeze over the juice of the lemon and the passion fruit. Serve with whipped cream.

Mixed Fruit Jelly.

Take 2 large apples, 3 bananas, a nice piece of papaw, a small piece of pineapple, and any other fruit you like. Cut it all up in nice, fine slices, squeeze passion fruit all over the top, sweeten a little, then make a pint of jelly, and when fairly cool pour over the fruit. This can be eaten with whipped cream or custard or served plain.

Papaw Dessert.

Cut up in rather large pieces, put in enamelled stewpan with about a pint or so of water to 3 lb. of fruit, 1 small teacupful of sugar, the juice of 2 lemons, bring to the boil and simmer for 10 minutes, set aside to cool, and serve with a milk pudding, or it may be set in jelly.

Papaw Salad.

By adding a little orange or lemon juice to diced or mashed papaw you can produce a lovely salad in a few minutes. This is the most inexpensive fruit salad possible and is simply delicious.

Tropical Fruit Salad.

Papaws, bananas, and pineapple combine to make a delicious tropical fruit salad. Use in quantities to suit taste, dicing the papaw and pineapple and slicing the bananas. Crush a little of the pineapple to secure juice and sprinkle this over whole with a little sugar, and serve.

Icy Fruit Slices.

Cut a papaw into sections lengthwise, sprinkle with lemon and sugar, and place in ice chest until thoroughly cold. When serving sprinkle with crushed ice if desired.

Crystallising Fruits.

Choose good sound fruit, not too ripe, and prick with a needle. Place in a pan of cold water and bring to the boil. The fruit will rise to the surface, and must be lifted out and placed carefully in cold water. Prepare a syrup by boiling 2 lb. of cane sugar in 1 pint of water till on dipping a skewer into the syrup and blowing through it bubbles will be formed on the other side of the skewer. Then put the fruit into the syrup and boil up. Remove the scum. Take the pan off the fire and pour contents into a basin. Leave till the next day, then pour off the syrup and boil till it threads. Pour over the fruit and allow to stand overnight. Repeat the process for four days and on the fifth day boil the syrup to the "crack," dip the fruit into it and drain on a sieve in a warm place. Sprinkle with fine sugar. Pack carefully and keep in a cool, dry place.

Papaw Tart.

One and a-half cups of self-raising flour, rub in 1 tablespoon of butter, add 1 teaspoon of sugar and a little salt. Mix with milk or water to make a light dough. Roll out thin, spread on a plate, prick all over, and fill with thinly sliced papaw sprinked with sugar and lemon juice or passion fruit. Cover with pastry and bake in a moderate oven.

Frozen Papaw Jelly.

Peel a firm fully ripe papaw, cut the end sufficiently to allow the removal of seeds. Dissolve jelly crystals, when cool pour into papaw cavity; place on ice and allow to set. Cut into rings and serve with whipped cream.

VALUE OF PINEAPPLES.

Pineapples are undoubtedly one of nature's health correctives and healers. Their richness in vitamin A helps to prevent common colds and those eye ailments so prevalent amongst children, particularly in the inland districts of Australia. At the first sign of a cold or when colds are prevalent eat pineapples freely. Being rich in vitamin B, they promote body growth. Owing to their vitamin C content, pineapples are recommended by doctors as a precaution against pyorrhœa, which, according to the "Medical Press and Circular," is largely a dietary affection.

Dr. J. R. Killian, a distinguished American scientist, specialising in the study of nutrition, states that the fight against pyorrhœa and dental decay will be helped in the future by a liberal use of pineapple in the diet.

Pineapples are of great value in after treatment following tonsil removals, and assist the stumps to heal. The pure juice is a proved reliable ferment for dissolving necrosed tissue in quinsy.

These benefits are available to all, as where the fresh fruit is unobtainable the canned pineapple—retaining as it does the properties of the freshly-picked fruit—may be used.

Its uses in the kitchen are legion. Slices fresh or canned, served with cold meat have an appeal which ensures their continued use, particularly with corned meat. To the busy housewife the pineapple presents an easy solution of the ever-present dessert problem. No dish is more quickly prepared or more appetising than grated pineapple, fresh or canned. Its popularity never wanes.

A fruit salad can be rapidly made by the use of pineapple, fresh or canned, and one or more of any fruits in season. For cooked desserts the pineapple may be served in a multiplicity of ways, and the following recipes are recommended:—

Pineapple Jelly.

Wash a good half-breakfastcupful of sago, put in a large jug with half-cupful water, 1 cupful sugar, 2 grated pineapples, and juice of 1 lemon. Put the jug in a pan of boiling water and stir until clear, then put in moulds until cold. Serve with custard or grated pineapple.

Pineapple Fritters.

Put flour in basin, add pinch of salt, baking soda and cream of tartar, the usual quantities to each pound of flour, 1 tablespoonful sugar, and 1 egg to each pound of flour. Mix all together with milk, or half milk and half water, to a nice batter, dip in pieces of pineapple, and fry to a nice brown. Condensed milk may be used if fresh is not available for the batter, by mixing at the rate of 1 tablespoonful to a pint of cold water. This mixture of batter may be used for bananas, mangoes, or apples, or any fruit that is used for fritters.

Pineapple Pie.

Two cupfuls grated pineapple, 1 cupful water, cupful sugar, 2 tablespoonfuls breadcrumbs. Line pie-dish with paste, mix pineapple, water, sugar, breadcrumbs, and yolks of 2 eggs, bake, and when cool beat up the white of eggs and put over pie.

Pineapple Turnovers.

Make a flaky pastry from 2 cups of self-raising flour and half-cup dripping. Cut out shapes the size of a tea plate, put a spoonful of chopped pineapple and a little sugar on each fold, press over the edges of the pastry together, and bake in a brisk oven. The turnovers are better served with hot custard.

A delicious pineapple drink may be made in either of the following ways:—

Pineapple Syrup.

Keep the skins of your pineapples and boil slowly and well in plenty of water. Strain through cloth and add sugar to taste. This makes a delicious drink and retains all the medicinal qualities of the pineapple.

Pineapple Water.

Peel a medium-sized pineapple and cut it into pieces, pound it to a pulp, and mix with it 1 pint of boiling syrup and the juice of 1 lemon, and let it all stand covered for two hours; now strain, and add 1 quart of water, and ice.

HOW TO MAKE SOAP.

Materials.

6 lb. clean dripping; 2 gallons water; 1lb caustic soda; ½ lb. resin; 3 tablespoons borax or kerosene.

Method.

1. Put dripping, resin, and water into a boiler or kerosene tin.
2. Boil until all fat is melted—15 to 30 minutes.
3. Add borax or kerosene; remove from fire.
4. Add caustic soda direct from the tin gradually, allowing bubbles to subside between each addition.
5. Boil gently for one or two hours.
6. Pour into a box lined with a damp cloth.
7. When solid, cut into bars and store in a dry place until hardened.

RANCIDITY IN FRESH CREAM.

A rancid flavour in fresh cream is a most unexpected trouble with dairy farmers, as this defect is usually associated with old, stale cream. Each year, however, particularly from March to July, authentic reports are received of cream (less than twenty-four hours old) being degraded on account of rancidity.

A substance called lipase is the cause of the trouble. Lipase is an enzyme which occurs in milk and cream, and has the property of rapidly decomposing the fat. Its greatest damage is noticeable when cows are approaching the end of their milking period, and usually only one or two cows in the herd are responsible for the spoilage that occurs in the milk or cream.

When confronted with this trouble, farmers are advised to examine the milk from each cow until the offending animals are identified. This may be done by holding about half-a-cupful of milk from each animal for six or eight hours and tasting and smelling at intervals. A sickly, rancid smell and taste will signify the troublesome ones, and the milk from these cows should not be mixed with the bulk milk for separation.

The defect becomes worse hour by hour, and there is no way of stopping its action except by heating almost to boiling point. If such milk is desired for home use it should be boiled immediately it is drawn from the cow.

The Tropics and Man

INFLUENCE OF CLIMATE ON THE EUROPEAN.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M.,—Professor of Physiology, University of Queensland.

No. 1.

"THE proper study of mankind is man," said Alexander Pope in a well-known poem. But I wonder, do we really appreciate what wonderful beings we really are, or do we study ourselves enough? Do we realize on the one hand what we are capable of accomplishing if only we set about it on the right lines, or, on the other, do we remember sufficiently often the extraordinary intricacy and delicacy of our body's mechanism? Those of us whose footsteps have been led by fate into such paths of enquiry might sometimes be temped to pride ourselves on our understanding of the human body, but is our understanding after all very complete, or, for that matter, do we practise ourselves the behaviour we order for others? Is it not usually the case that the medical man or nurse makes the worst patient?

The more closely I have been brought into contact with man's reactions to the various stresses forced upon him by tropical residence, the more I realise our profound ignorance of what hot climates alone do to him, that is, hot climates stripped of their usual accompaniments of infection, social obligations and economic peculiarities. At the same time, the realization of ignorance does not breed pessimism; rather does it appear that closer and more exact study of the actual position should point out how man can better triumph over the present disabilities imposed by hot climates and impose in turn his superiority upon nature in areas and ways as yet only toyed with by him. *But*, first must come knowledge. Action in ignorance or in unthoughtful defiance of nature can end only in disaster, even though its initial stages be tended with apparent success.

It has been pointed out many times by better writers than I, that tropical Australia as a whole, and Queensland in particular by virtue of its larger experience, forms a unique field for the investigation of tropical influences on the European. The position still remains. We still possess a "White Australia," we are still comparatively free from those infectious diseases so prevalent and so devastating in other tropical countries, and we are still conducting with success a mass experiment in European settlement of a tropical country. Many pioneer attempts have been made to assess the progress of this experiment, and the effects of this settlement upon the white race. These assessments are very valuable indeed and provide information with which to compare later information. They suffered, however, from two factors beyond the control of these able investigators—lack of co-ordination one with the other, and absence of much valuable information available to-day from other sources. We are now in a much better position to take up the investigations where these workers were compelled to lay them down. Through the generosity and foresightedness of the Government, Queensland has become possessed of a Medical School of its own, which in addition to training medical students and imparting to them a special interest in tropical medicine, has taken unto itself the keenest interest

in the medical and allied human problems peculiar to the tropics. Organization of a large new undertaking is exacting and time-consuming, but already investigations have commenced and interesting considerations are emerging. From time to time in these pages, reference will be made to the progress of this work and hints given of what this work may mean for the average man in the Queensland tropics. As in the erection of a building, the preliminary work of research is of a mysterious character to those not conversant with the art, and little visible progress is made. Nevertheless, the foundations are the most important part and the more important the larger the subsequent edifice. There is a popular belief that professors, and indeed all University people, are peculiar persons given to burying their noses in abstruse problems out of touch with the realities of life, and to this belief is often attached an appeal to let the "practical" man decide what is to be done. The modern University in no way supports this conception, and to those who know the Queensland University and its courage in appointing youth to recent vacancies, such ideas are ludicrous. Mutual co-operation is the only path by which any State can be led to prosperity, and no group of people are more cognisant of this than the University Staff. National prosperity can be obtained only by national effort, and in this scheme all men must play their part.

Long-range success can be achieved only by long-range planning, and planning can go on intelligently only when adequate facts are available. These facts must cover every conceivable range of the problem, and if they are not available steps must be taken to make them available. Unfortunately, nature will seldom tolerate being overwhelmed with questions, but much prefers to be asked them one at a time in orderly sequence. There are two disadvantages in this, firstly that time and extensive personnel are required for this method, and secondly, separate answers when obtained, have to be fitted together again to make them relevant to the wide problem, a process by no means simple. Unfortunately, again, men are apt to lose patience with nature and discourse at length about her on the basis of very little evidence. The valuable contributions made by earlier investigators of tropical settlement in general and of Queensland's problems in particular suffered very much from hasty generalizations made on the basis of incomplete evidence. It is characteristic of scientific history that most observations have been quite correct, but that interpretations have been so ofter at fault. There can be no doubt that what the earlier workers reported was quite correct, but there can also be little doubt that a lot of the theory built up on that evidence—by no means at the hands of these workers alone—has never been verified. We must realize this, and recognise that we must return once more to *facts* and refuse to accept theory until it has been well tested, and then only to accept it until a better structure can be devised. All this may seem very airy and away from practical application, but I shall, in succeeding articles, frequently have cause to point out faults or weaknesses in present conceptions, and plead for a non-commital attitude until facts are forthcoming.

Granted a healthy doubt in unsubstantiated theories, how are we going to set about collecting the facts? The problem is so wide, and so inextricably mingled are the medical, physiological, economic and social factors that it would be a bold man who would categorically state that such and such is the only plan. I have had the opportunity of studying the problem fairly closely, and to me certain features stand out in

relief, but to others viewing the terrain from a different angle, other features would no doubt be prominent. For this reason I would, in somewhat Hibernian fashion, put as the first point in my plan that several highly competent investigators with different outlooks should co-operate in the formulation of a plan. My own particular interests would for their part then pass to considering just what the effect of hot climates upon an unacclimatised man are, in order to provide a basis from which to work. The next point would be to compare with this the effect of similar climates upon fully acclimatised persons. Having establised both ends as it were, of this mysterious process of acclimatisation, one could investigate its nature with a little more confidence. Once this process was "taped," one should be able to give rational advice about encouraging and hastening it without involving the calamities that are at present liable to occur. All of this sounds fairly simple and straightforward, but nothing is so elusive as facts, and, in any case, before we start, what is a tropical climate, what are its important factors and how do they act? The next few articles will be devoted to examining just these facts which we so often take for granted, but which are really the whole cause of our trouble.

[TO BE CONTINUED.]

WHEN OVERLANDERS MADE HISTORY—GREAT DROVING FEATS RECALLED.

Of the greatest droving feats in Australian history, one is that which was effected by C. and W. Macdonald, of Clifford's Creek, Goulburn, New South Wales. Starting from The Junction, Tuena, with just over 1,000 head of cattle and 100 horses, to form Fossil Downs Station in partnership with the MacKenzie brothers, in Western Australia, and further supplemented by TYI cattle from Tininburra Station, Queensland, they arrived at their destination after having been three years on the road.

Only 13 horses of the 100 survived the trip, though most of the cattle arrived safely, and their brand, the Z/5, is still used by descendants of the MacKenzie family in New South Wales, as well as the Fossil Downs Station. One of the brothers who made the trip was later speared by blacks, and the other contracted pneumonia and died while returning on holiday to Goulburn.

The drover with consistently low loss tallies never wants for a job, and one of the best performances of this kind was put up by Jerry Conolly, a well-known Centralian drover, who started from the Northern Territory with 1,224 bullocks. After covering nearly 2,000 miles over notoriously bad country, he delivered the herd at Muswellbrook, New South Wales, only four short. These had been drowned in crossing a flooded river, and the rest were in first-class condition. The magnitude of this feat can be gauged when it is realised that trips such as this took many months, and sometimes years, to complete.

But in the droving history of Australia the performance which stands out from all others is the early trans-Commonwealth drive of Mick Durack and Tom Kilfoyle. Leaving Mount Marlow Station, Queensland, with 2,000 cows in 1883, they covered 2,500 miles, and arrived at the Ord River, Western Australia, two and a-half years later, in 1885.

Travelling over practically unknown country, menaced for the greater part of the journey by hostile blacks, stricken down repeatedly by fever, and encountering such troubles as long dry spells without water, hungry crocodiles waiting for them at every river crossing, they arrived with practically the whole of their herd intact. Their arrival has been recorded on a huge baobab tree on the bank of the Ord River, about 120 miles inland from Wyndham, and it has been preserved as a memorial to the feat.—Kingsley Temple, in "The Australasian."

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF NOVEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1936 AND 1935, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of Years' Records.	Nov. 1936.	Nov. 1935.
North Coast.	In.		In.	In.
Atherton	2·42	35	0·37	1·25
Cairns	3·95	54	0·94	2·91
Cardwell	4·19	64	2·50	4·35
Cooktown	2·53	60	1·91	0·38
Herberton	2·62	50	0·36	1·80
Ingham	3·87	44	0·99	1·04
Innisfail	6·33	55	1·47	4·64
Mossman Mill ..	4·35	23	4·28	3·88
Townsville	1·88	65	2·48	0·37
Central Coast.				
Ayr	1·77	49	0·12	0·16
Bowen	1·29	65	Nil	0·37
Charters Towers ..	1·44	54	0·82	0·04
Mackay	3·12	65	0·38	0·81
Proserpine	2·95	33	0·29	0·81
St. Lawrence ..	2·42	65	1·04	0·15
South Coast.				
Biggenden	2·82	37	0·86	Nil
Bundaberg	2·70	53	3·34	0·15
Brisbane	3·78	84	1·35	1·26
Caboolture	3·53	49	2·41	0·48
Childers	2·79	41	1·74	Nil
Crohamhurst.. ..	4·91	43	2·60	1·76
Esk	3·26	49	2·27	1·61
Gayndah	2·97	65	0·99	0·05
Gympie	3·26	66	2·25	0·18
Kilkivan	2·58	57	2·50	0·10
Maryborough ..	3·23	65	2·09	1·52
Nambour	4·06	40	2·48	0·95
Nanango	2·76	54	1·81	0·16
Rockhampton ..	2·43	65	2·46	0·07
Woodford	3·28	49	2·05	0·71
Central Highlands.	In.		In.	In.
Clermont	2·04	65	0·16	Nil
Gindie	2·17	37	..	0·04
Springsure	2·20	67	0·10	0·05
Darling Downs.				
Dalby	2·79	66	0·78	0·58
Emu Vale	2·71	40	1·67	0·26
Hermitage	2·63	30	..	0·09
Jimbour	2·59	48	0·78	0·20
Miles	2·63	51	1·36	0·37
Stanthorpe	2·73	63	1·24	0·70
Toowoomba ..	3·33	64	1·59	0·39
Warwick	2 63	71	1·66	0·17
Maranoa.				
Roma	2·19	62	1·50	0·56
State Farms, &c.				
Bungeworgoral ..	2·53	22	1·03	Nil
Gatton College ..	2·95	37	3·00	0·31
Kairi	2·42	22	..	..
Mackay Sugar Experiment Station	2·86	39	0·35	0·79

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—NOVEMBER, 1936.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Means at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·87	88	75	91	20	69	10	191	3
Herberton	..	84	60	93	16	52	10	36	3
Rockhampton	29·96	90	68	99	10	62	12	246	7
Brisbane	29·99	84	65	95	21	55	2	135	4
Darling Downs.									
Dalby	29·95	89	60	102	9	48	13	78	6
Stanthorpe	..	82	52	96	9	39	2	124	4
Toowoomba	..	83	56	96	7	43	2	159	7
Mid-Interior.									
Georgetown	29·87	98	72	105	19	58	1	86	4
Longreach	29·90	97	66	107	20	53	12	29	5
Mitchell	29·93	90	60	104	8	42	2	97	6
Western									
Burketown	29·86	97	74	105	18	65	24	33	3
Boulia	29·88	98	68	108	8	56	2	120	3
Thargomindah	29·92	94	65	109	7	53	12	Nil	..

ASTRONOMICAL DATA FOR QUEENSLAND.

. TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	January, 1937.		February, 1937.		MOONRISE. Jan., 1937.	MOONRISE. Feb., 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·0	6·50	5·26	6·47	9·32	9·49
2	5·1	6·50	5·26	6·46	10·21	10·24
3	5·2	6·50	5·27	6·46	10·45	11·1
4	5·3	6·51	5·27	6·45	11·16	11·42
5	5·4	6·51	5·28	6·44	11·51	..
						a.m.
6	5·5	6·51	5·29	6·44	..	12·27
					a.m.	
7	5·6	6·52	5·29	6·43	12·27	1·15
8	5·7	6·52	5·30	6·42	1·2	2·11
9	5·7	6·52	5·31	6·42	1·47	3·8
10	5·8	6·52	5·31	6·41	2·35	4·10
11	5·9	6·51	5·32	6·40	3·28	5·10
12	5·9	6·51	5·33	6·39	4·24	6·12
13	5·10	6·51	5·33	6·39	5·28	7·14
14	5·10	6·51	5·34	6·38	6·21	8·14
15	5·11	6·51	5·35	6·37	7·21	9·18
16	5·12	6 50	5·35	6·37	8·22	10·21
17	5·13	6·50	5·36	6·36	9·21	11·32
						p.m.
18	5·14	6·50	5 37	6·35	10·32	12·36
19	5·14	6·50	5·37	6·34	11·26	1·37
20	5·15	6·50	5·38	6·33	12·29	2·30
21	5·16	6·49	5·39	6·32	1·35	3·21
22	5·17	6·49	5·39	6·31	2·40	4·12
23	5·18	6·49	5·40	6·30	3·42	4·54
24	5·19	6·49	5·41	6·29	4·40	5·33
25	5·19	6·48	5·42	6·28	5·34	6·8
26	5·20	6·48	5·43	6·27	6·17	6·41
27	5·21	6·48	5·44	6·26	6·59	7·14
28	5·22	6·48	5·45	6·25	7·36	7.47
29	5·23	6·47			8·10	
30	5·24	6·47			8·44	
31	5·25	6·47			9·18	

Phases of the Moon, Occultations, &c.

4 Jan. ☽ Last Quarter 12 22 a.m.
13 „ 🌑 New Moon 2 47 a.m.
20 „ ☾ First Quarter 6 2 a.m.
27 „ ○ Full Moon 3 15 a.m.

Apogee, 7th January, at 1.0 a.m.
Perigee, 22nd January, at 1.0 p.m.

On the 14th Mercury will be in inferior conjunction with the Sun (in a line between the Earth and Sun) and on that occasion at a distance of more than 55,000,000 miles from the Earth.

On the 14th also Uranus will become stationary, which can never be an interesting phenomenon to the ordinary observer, since Uranus can only on rare occasions be seen without good optical aid by those with excellent eyesight; moreover, it is among very small stars in the south-west corner of Leo.

On the 17th Venus will be 6 deg. south of the Moon at 1 a.m., and Saturn on the same day 8 deg. south of it at 2 p.m. They will be above the horizon within 3 hours after sunset.

Venus, which since the middle of November has passed through the whole of Capricornus into Aquarius, will there on 24th January meet the distant and slowly moving Saturn, which has been in that constellation since January last. It will be seen as a fairly close conjunction after sunset, since they will be separated by about 2 deg. at moontime.

The Southern Cross, which was absent from the evening sky at Christmas time, will come into view at Warwick about 9 p.m. and at Brisbane not until 11 p.m., low down in the S.S.E. at the beginning of January.

Mercury rises at 6.27 a.m., 1 hour 27 minutes after the Sun, and sets at 8.9 p.m., 1 hour 19 minutes after it, on the 1st; on the 15th it rises at 5.15 a.m., 4 minutes after the Sun, and sets at 6.43 p.m., 8 minutes before it.

Venus rises at 8.21 a.m., 3 hours 21 minutes after the Sun, and sets at 9.54 p.m., 3 hours 4 minutes after it, on the 1st; on the 15th it rises at 8.41 a.m., 3 hours 30 minutes after the Sun, and sets at 9.27 p.m., 2 hours 36 minutes after it.

Mars rises at 12.30 a.m. and sets at 1.20 p.m. on the 1st; on the 15th it rises at 11.59 p.m. and sets at 12.59 a.m.

Jupiter rises at 4.45 a.m. and sets at 6.35 p.m. on the 1st; on the 15th it rises at 4.6 a.m. and sets at 5.52 p.m.

Saturn rises at 10.8 a.m. and sets at 11.48 p.m. on the 1st; on the 15th it rises at 9.23 a.m. and sets at 9.5 p.m.

3 Feb. ☽ Last Quarter 10 4 p.m.
11 „ 🌑 New Moon 5 34 p.m.
18 „ ☾ First Quarter 1 49 p.m.
25 „ ○ Full Moon 5 43 p.m.

Apogee, 3rd February, at 10 p.m.
Perigee, 16th February, at 6 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

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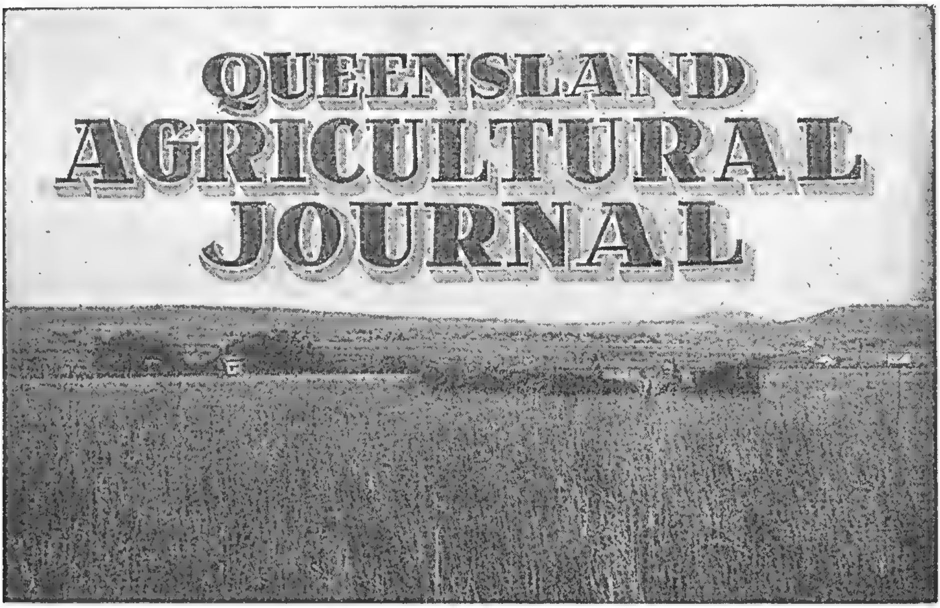

VOL. XLVII. 1 FEBRUARY, 1937. PART 2

Event and Comment

Protection for the Farmer.

IN the course of a recent announcement the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, stated that the question was frequently raised: How do farmers of other countries supplying the British market at parity succeed in remaining solvent while our farmers say that solvency under these conditions is impossible? The reasons were not hard to discover, he remarked. Many of the countries supplying Britain with dairy produce had an exceedingly low standard of livelihood in comparison with that established in the Commonwealth, and it was no exaggeration to say that the production in those countries was frequently the production of people who were little better than serfs.

In addition, tariff policies increased the Australian farmer's cost of production, and if the producer were compelled for national reasons to purchase in a protected market, was it not reasonable to assume that he could not afford to sell in an open market?

Continuing, Mr. Bulcock said that without protection Australia would be a dumping ground for the products of cheap and exploited labour countries, and our industrialists would soon be out of work. The referendum would ask that the same protection should be applied to the farmer as was extended to other and larger sections of the community.

Practically every major agricultural country in the world was organising production and marketing, and Britain attached great importance to this activity. It was said that the House of Commons is now more agriculturally minded than has been the case during the past century; and Canada and the United States of America are associated with orderly marketing, because they, in common with all other countries, realise that the soil is the source of all our wealth. Here in Australia, we, too, are recognising this elementary truth very clearly, and, in addition, are also realising that the producer is a consumer. In order to build up our industries the farmer must have adequate purchasing power. In other words, if he cannot purchase industries languish and unemployment increases. But the farmer cannot purchase if he is singled out for adverse economic treatment.

The Farmer's Purchasing Power.

IF the referendum is carried the farmer's purchasing power will be strengthened, and all sections of the community will therefore benefit. If it be not carried the farmer's purchasing power will wax and wane, in response to overseas price movements, and the first essential of economic progress—stability—will be missing,'' added the Minister. He then proceeded to examine the position in the event of the people of Australia refusing to give the producer stabilisation and a domestic price.

For a brief period they would remain on their present level of production, but slowly and surely uneconomic prices would drive many producers out of agriculture. Then there would be a rise in prices, production would increase to a point, where uneconomic prices again intervened, and production would again decline.

Organised marketing sought to prevent this happening. Nationally it was disastrous, and the consumer over a number of years gained nothing. But we as a people could not afford to yield our fate to uncontrolled economic force, and as development and yet more development was necessary, we must concede to the producer that which was esesntial, not only to his wellbeing but to the security and solvency of the Commonwealth.

Lack of Close Agricultural Organisation.

AGRICULTURE is, generally speaking, the one major activity of mankind which is not satisfactorily organised, said Mr. Bulcock. Industry and labour had entered into national and, in some cases, international alliances for their protection. It was clear that the benefits accruing to an organised section might be paid for by an unorganised section, and it followed that, so long as farming was an unorganised occupation it would be compelled to make a contribution, not only to its own maintenance, but also to the maintenance of other enterprises.

Obviously, that was a condition that should not be perpetuated, but we had heard from time to time of an opposition developing to the proposed referendum. So far as could be seen, the Governments of three States of the Commonwealth favoured the referendum. Within those three States was produced 90 per cent. of the total of Australia's agricultural exports. The other States, representing only 10 per cent. of export production, had it in their power to prevent the farmers' achieving that degree of economic stability which was their due.

Price Movements.

AN interesting phase of that question presented itself if one studied price movements in Queensland and similar movements in the Southern States, Mr. Bulcock continued. It was generally conceded that the farmer in Queensland is far better off than the farmer in any other State of the Commonwealth, the chief reason being that farming in Queensland is organised to the limit of the State's resources.

This, of course, was not the condition in any other State of our Federation, but, strangely enough, the cost of living in Queensland is the lowest of any State in the Commonwealth. It was clear, then, that organised marketing, properly regulated, does not make a levy on the family budget, but does relieve the taxpayers in the final analysis of maintaining people who are engaged in an industry made unremunerative by an adverse economic structure.

In these days, when it is popular to talk about tax reductions, it is well to look at the volume of assistance that the taxpayers of Australia have given the primary producer. Bounties in many directions are becoming established axioms of our agricultural life, and I know of no more inadequate way of permanently assisting farming than to levy the taxpayer to provide a bounty to buoy up an industry that can only be solvent when organised. Organised marketing very reasonably can mean a reduction in the sum total of taxation levied by the Commonwealth.

Babel or Pentecost?

CONCLUDING, Mr. Bulcock expressed the opinion that the farmers of Queensland would, without doubt or hesitation, vote for the referendum. "I am convinced," he said, "that the consumer will not inflict any restriction on his purchasing power by supporting it. Where, then, does the opposition arise? A study of the organised marketing movement in Queensland will show that, as this type of organisation was achieved, it met with the hostility of certain interests who, until the advent of organised marketing, had been successful in intercepting the commodity as between the producer and the consumer, and levying tribute upon it, which was paid, of course, by the consumer and producer.

"Commonwealth marketing would mean in many instances that this intermediate levy would not be possible of collection by interested parties, and consequently the matters associated with this referendum cannot be expected to receive the blessing of the individual who prefers to farm the farmer rather than farm the land.

"In conclusion, I would say that there are three unassailable reasons why this referendum should be supported:—

(1) Because it has a basis of natural justice;

(2) Because Australian solvency depends on the organisation of our primary production.

(3) Because the future of Australia is so intimately wrapped up with our agriculture that everything possible must be done in order to conserve and expand primary undertakings."

Citrus Diseases.

J. H. SIMMONDS, M.Sc., Senior Plant Pathologist.

THE extent to which citrus is affected by disease in Queensland varies greatly with the location in which it is grown. In the drier inland districts, with the exception of certain physiological troubles such as mottle leaf, disease is not an important factor. On the coast, however, where warm moist conditions normally prevail during spring and summer the presence of diseases, especially those affecting the fruit, makes it difficult to produce citrus of satisfactory appearance and quality. When spraying is necessary, Bordeaux mixture has been found efficacious. However, this spray possesses the disadvantage that its continued application has a detrimental effect on citrus trees as well as promoting an increased scale insect infestation. For this reason it has been the practice to add 1 per cent. of emulsified red oil to the Bordeaux. In addition to acting as a spreader the oil is believed to check scale development to some extent and so minimise the ill effects of the Bordeaux in this respect. However, if more than one application of Bordeaux is made it is usually necessary to take special precautions later in the season for the control of the scale. For this purpose the resin-soda-fish oil spray is recommended, the use of which is described in Bulletin No. 10, "Queensland Scale Insects and their Control." Recent experiments indicate that colloidal copper may prove a useful substitute for Bordeaux mixture on citrus since it is an effective fungicide and yet does not tend to increase scale infestation to nearly the same extent. In those districts where scale insects are a serious problem it is recommended that a trial be made of this spray.

The control of some Queensland citrus diseases is still under investigation, and in these cases it has been possible to make only preliminary recommendations.

BLACK SPOT.

Black spot is probably the most common and destructive disease of citrus in Queensland. Most commercial varieties are subject to its attack.

The disease is almost entirely restricted to the fruit, and does not usually appear before the latter is colouring or approaching maturity. Minute reddish-brown spots appear scattered over the surface of the rind on the side exposed to the sun. These develop into circular areas one-sixteenth to one-eighth of an inch in diameter, and the central portion becomes shallowly depressed and may assume a greyish colour. On fruit which has fallen or which has been stored for some time, a brown and somewhat shrunken area may extend out from the initial spots and cause serious blemishes. (Plate 41, figs. A and B.) Black spot is much more prevalent on exposed fruit on the sunny side of the tree. Affected fruit will not hang on the tree when ripe, and loss is occasioned by the fruit falling off before picking as well as by the actual disfigurement.

Black spot is caused by a fungus (*Phoma citricarpa*). Unlike the organisms causing most other diseases of citrus, this fungus is restricted to Australia and some Eastern countries. The spores which spread the disease are contained in small flask-shaped receptacles imbedded in the rind. These may be seen as minute black points studding the centre of the spots.

Control.

(1) As with other citrus diseases, the incidence of black spot can, to a certain extent, be lessened by keeping the trees in a healthy, vigorous condition by satisfactory manuring and cultivation. Dead and sickly wood should be pruned out.

(2) Fallen fruit should be picked up and destroyed by fire or burying.

(3) Experiments have shown that black spot may be controlled by spraying with Bordeaux mixture. This work is not yet completed, but until further results are available the following schedule can be recommended.

It should be realised that most of the infection takes place when the fruit are very young and probably little or none later than six months after setting, although the actual spotting does not appear until the fruit are approaching maturity and changing colour.

Spray with Bordeaux mixture (3-2-40), to which 1 per cent. (approximately ½ gallon to 40 gallons) red oil well emulsified in its own volume of water has been added as a spreader at the following times:—

(1) When the greater part of the blossom has fallen (i.e., more than 75 per cent.);

(2) About two months later in December.

If infestation by scale becomes too heavy, special precautions will have to be taken for their destruction as recommended in the introduction. Growers are advised to try the substitution of colloidal copper for the Bordeaux mixture.

MELANOSE.

Melanose is a trouble which is to be found most frequently in old or neglected orchards. Leaves, twigs, and fruit are all affected, though it is on the last that the disease is most conspicuous. Here the lesions consist of small brown specks or dots rarely exceeding one-fiftieth of an inch in diameter, which are scattered sparsely or abundantly over the surface of the rind. (Plate 41, fig. D.) These appear at first as a surface stain only, but later they become slightly elevated and somewhat fissured diagonally or round the margin, so that a melanose-affected fruit is decidedly rough to the touch. Examined microscopically, the lesions are seen to consist of two or three layers of brown, gum-filled cells which, in later stages, become elevated by the development of corky tissue beneath. The spotting in the leaves and twigs resembles in general appearance that on the fruit, except that it is black rather than brown in colour.

When the spots are so numerous as to coalesce, melanose is sometimes mistaken for maori or exanthema. The brown discolouration of the typical maori orange, however, is not broken up into distinct spots and is quite smooth to the touch. On a fruit affected with exanthema the spots are less uniform in size. There is a tendency for the formation of a blotchy condition rather than distinct spots, and the skin is more definitely hardened.

It is a fungus (*Phomopsis citri*) which is responsible for melanose. This organism, however, does not develop on the living part of the tree, but on dead twigs. Here it forms its spores, which become washed down

over the young fruit and foliage. If wet weather occurs when the tree is in the susceptible stage, these spores will germinate and affect the young growing tissue just sufficiently to cause the spotting described above.

The dependence of the melanose fungus on the presence of dead wood for its existence explains why it is the older or neglected orchards that suffer most from this disease. It is only young shoots and fruit which are susceptible to infection. As the growth hardens off it becomes progressively more resistant. Hence, in any spraying programme, it is necessary to provide for protection at the critical period.

Control.

(1) So far as is practicable, remove all dead twigs and branches. Practise a system of fertilizing and good cultivation, with a view to promoting strong, healthy growth.

(2) Immediately all the petals have fallen, spray with Bordeaux mixture of 3-2-40 strength, to which has been added 1 per cent. of well-emulsified red oil, to act as a spreader and help keep scale insects in check.

If it is desired that this spray should also act as a control for scab—as, for example, when lemons or mandarins are to be treated—the spray may be applied as early as half petal fall, but it should never be later than the time given above.

SCAB.

Only lemons and mandarins are subject to this disease, the young leaves, shoots, and fruit being affected as in the case of melanose. The scabs are quite characteristic of the disease, and consist of irregular, light-brown, corky outgrowths. These may be no larger than melanose spots, or may be distinctly wart-like projections. On the leaf there is often a small conical depression of the blade bearing a mass of cork tissue at its apex. Considerable distortion and stunting of the leaf may occur if the scabs are numerous. On the fruit, especially of the lemon, large scab-covered projections may be formed by an outgrowth of the surrounding rind tissue. (Plate 41, fig. E.)

Scab is due to the presence of a fungus (*Sporotrichum citri*), whose fruiting stage appears as a delicate greyish mould covering the surface of young scabs. As in the case of melanose, the fungus can infect only young growth. Rain at the time of a new flush of growth is essential for scab development.

Control.

Spray with Bordeaux mixture, 3-2-40 strength, plus 1 per cent. of well-emulsified red oil, at the middle of the spring flowering period —that is, when about half the petals have fallen.

It is important that this application should be made at the time stated and not delayed until later. The lemon normally has more than the one fruiting period, and, consequently, it may be advisable to spray again at a similar time with respect to other main blossomings.

The remarks made previously with reference to scale infestation apply to a certain extent to melanose and scab control also.

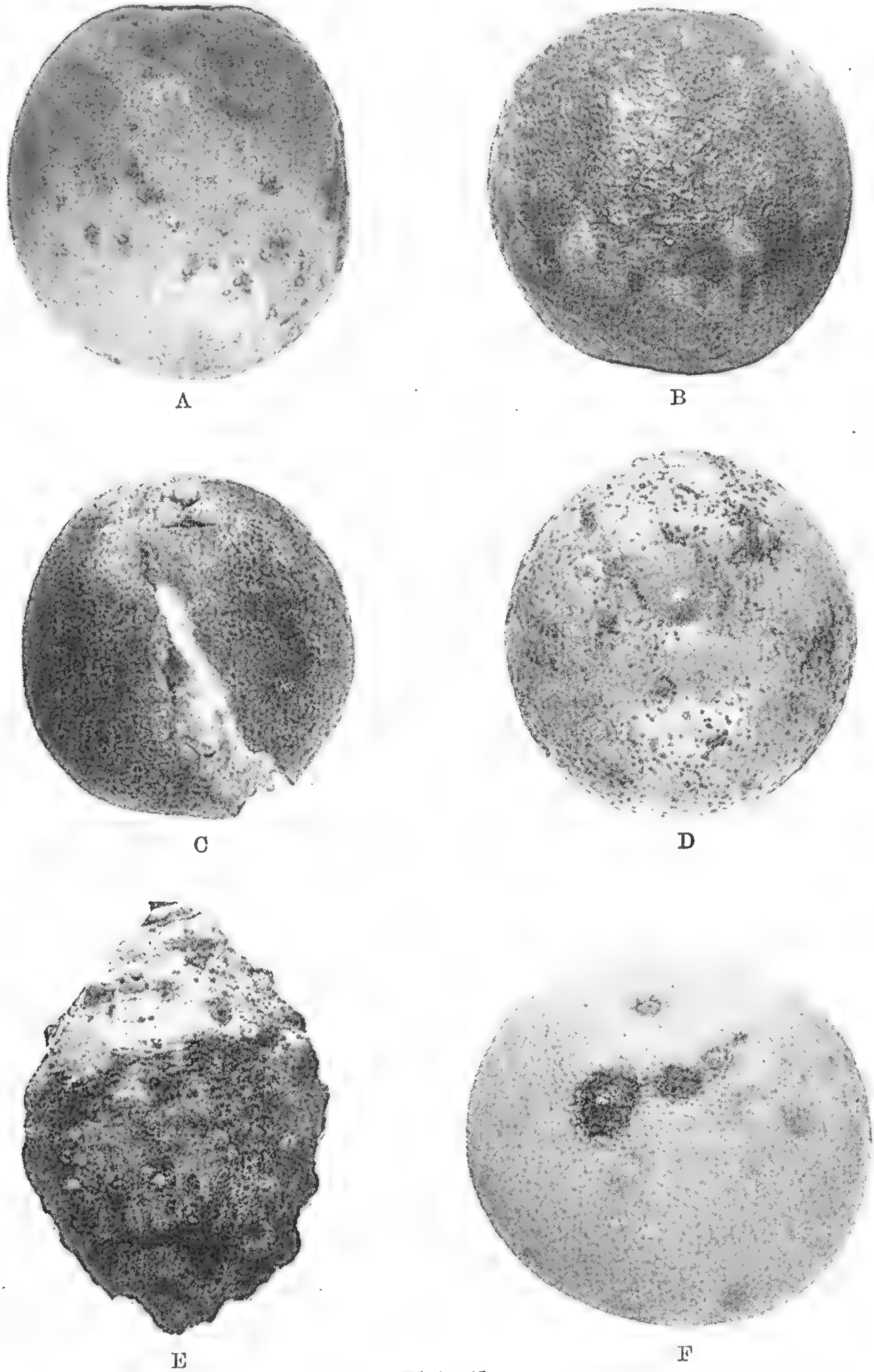

Plate 41.

Citrus Fruit Diseases.

A. Black spot on orange.
B. Later stage of black spot infection.
C. Exanthema on orange.
D. Melanose on orange.
E. Scab on lemon.
F. Brown spot on Emperor mandarin.

BROWN SPOT OF THE EMPEROR MANDARIN.

This is one of the most serious citrus diseases of this State, though, fortunately, the Emperor of Canton mandarin is apparently the only commercial citrus variety which is susceptible, and the disease is not widely distributed. Every care needs to be taken to ensure that there is no spread to fresh centres.

The symptoms take the form of dark-brown spots on the leaves, fruit, and younger branches. These can be distinguished from the lesions of black spot, in that they are larger and are a uniform brown colour without a lighter centre; also, the fungus pustules characteristic of the latter disease are absent. (Plate 41, fig. F.) On the leaf the browning may extend out along the veins to give a characteristic streaking. On the branches small cankers may develop from the original centres of infection as the wood matures. Small beads of gum exudate are often associated with these. Affected leaves and fruit drop readily when once attacked, and it is in this way that most loss is sustained. The falling of the younger leaves is often accompanied by a dieback of the young shoot, which is then spotted and blackened in appearance. The spots may appear on young tissue of fruit and foliage as soon as they are developed should other conditions be favourable. The cause of this disease is still unknown.

Control.

For the past four years experiments have been carried out to determine the best spraying programme to control brown spot, and although the work is still in progress the following can be recommended:—

(1) When about half the blossom has fallen spray with Bordeaux mixture (3-2-40), with 1 per cent. well-emulsified red oil as a spreader.

(2) About four weeks later spray with colloidal copper (3 gallons stock solution to 40 gallons water).

(3) During mid-December spray again with colloidal copper.

(4) During late February spray again with colloidal copper.

As in the case of black spot control, an application of resin-soda-fish oil spray may be used to overcome any excess scale development, in which case it should be made as late as practicable. Growers may try substituting colloidal copper for the Bordeaux in the above schedule.

BLUE MOULD.

Blue-mould rot of citrus fruits is caused by one of two allied fungi —*Penicillium digitatum*, which forms a powdery spore mass, olive-green in colour, on the surface of the rotting fruit, and *Penicillium italicum*, considerably less common, in which the spores are blue.

The rot commences as a soft, water-soaked spot on the rind almost invariably associated with some form of injury, slight or otherwise. As the softening extends, the surface of the affected area soon becomes coloured with the blue or green covering of spores, which are dislodged in a cloud when touched. Finally, the fruit is reduced to a soft, watery mass.

Most of the loss occasioned by blue mould occurs when sweating or during transport. The reason for this development has been investigated in various countries for many years. The conclusions arrived at should be carefully studied, as they have an important bearing on control. They are as follows:—

(1) The blue-mould fungi are relatively weak parasites, and are unable, as a general rule, to penetrate perfectly sound fruit.

(2) The wounds occasioned during picking, carting, and packing serve as the centres of infection for the blue-mould spores, which are always present in the air of the packing-house unless strict sanitation is practised. Common forms of injury are case bruises and cracks, stalk punctures, scratches from the finger-nail or other agencies. Insect damage, growth cracks, thorn pricks, and other injuries occurring in the orchard may sometimes result in fruit becoming infected while still on the tree.

(3) Loss can, to a large extent, be overcome by cleanliness and careful handling of the fruit.

Control.

Keeping the above facts in view, the value of the following recommendations should be obvious:—

(1) Collect at frequent intervals all waste fruit in the orchard and packing-house and destroy by burning or burying.

(2) Take care that no injuries are given by the clippers or finger-nails during picking. Fruit should be cut, not pulled. Long stalks must be avoided, and a second cut made if necessary, while the fruit is still in the hand. Avoid picking during wet weather or when dew is present.

(3) Collecting boxes must be smooth and the fruit placed in them carefully. Packing-cases should be of smooth wood. Careful and accurate packing is essential to avoid bruising and cracking, especially in the case of mandarins. Wrapping the fruit is helpful in reducing case-bruising and in localising the centres of infection.

(4) Citrus fruit is best allowed to cure for three to seven days before packing. During this period and when grading, all rotting and blemished fruit should be discarded.

(5) Passing the fruit through a wash water containing 5 to 7 per cent. borax and other disinfectants helps to minimise the loss, but it is generally conceded that cleanliness and careful handling are of first importance, and except in certain exceptional cases are all that is required.

BROWN ROT AND STEM END ROT.

Brown rot caused by either of the two fungi *Phytophthora citrophthora* or *P. parasitica* and stem end rot due to two other organisms (*Phomopsis citri* or *Diplodia natalensis*) appear at sporadic intervals in Queensland, when they are mainly responsible for storage losses. In the northern part of the State brown rot caused by the first-mentioned organism has resulted in heavy loss of fruit and foliage in the orchard. These diseases are characterised by a dull brown rot extending over large areas of the skin. The rot is usually firmer than in the case of blue mould and the blue spore mass characteristic of the latter is absent. In the case of stem end rot the brown decay usually extends down from the button both externally and through the centre.

So far diseases of this type have not been sufficiently prevalent to warrant the investigation of special control measures. In the case of brown rot it is advisable to spray with Bordeaux mixture prior to the period when the disease is expected. For the stem end rots the precautions recommended for melanose control should be taken. It will be noticed that the fungus *P. citri* is also the cause of the latter disease, and *D. natalensis* has somewhat similar habits.

COBWEB OR PINK DISEASE.

Pink disease is found in the more tropical citrus-growing countries, and in Queensland is most common in the warm, wet, coastal belts, especially in the North. Many other crops, including rubber, coffee, tea, and mango, may also be attacked.

The presence of the disease is usually first indicated by the wilting of one or more small branches. A closer examination will usually show that there is a silvery growth of cobweb-like threads extending over the bark of the affected branch near where it joins healthy wood. (Plate 42, fig. C.) This cobweb growth belongs to the fungus *Corticium salmonicolor*. Some of the threads penetrate the bark and wood, and so cause the wilting and death of the branch as first observed. If not checked the fungus will extend down the branches, involving the destruction of larger limbs in its path.

During wet weather the fungus may develop a conspicuous salmon-pink encrustation over the lower, shaded and damp sides of the dead branches. This is the spore-bearing region, and is responsible for the common name of pink disease.

Control.

The essential factor in controlling this disease is not to delay treatment. Examine carefully any wilting or dead branch, and ascertain whether cobweb disease or an insect borer is present. If the former, remove the branch at least eighteen inches below the last point at which the fungus or discoloured bark can be seen. Burn the affected wood and paint the cut end of the branch for another eighteen inches back with Bordeaux paste or tar.

Examine the tree later to make sure that eradication has been complete, otherwise the process will have to be repeated.

PSOROSIS.

Psorosis was first recorded in Queensland in 1927, and has since been located in most of the citrus-growing districts. As the disease is slow to develop, there should be no difficulty in keeping it in check, provided that it always receives prompt and thorough treatment.

Psorosis is found on the main limbs and branches of trees six or more years old. The sweet orange, the mandarin and the grape fruit are susceptible, whereas the sour orange and the lemon are resistant.

The earliest symptoms are the appearance in localised areas of inconspicuous pimples or blisters and the formation of scales by the pushing up of small segments of the outer bark. Some gum formation is often associated with this. The flaking off of the bark extends out slowly, and after several years the wood beneath becomes affected and decays, with the result that the limb may be lost. (Plate 42, fig. B.)

Plate 42.

A—*Armillaria mellea* on orange root.

B—Citrus psorosis.

C—The cobweb stage of pink disease.

The cause of psorosis is not definitely known, though it is now thought that it may belong to the class of virus diseases and not be due to any fungus or bacterium. A satisfactory control is, however, available if treatment is commenced in the early stages.

When a localised area of scaling or pustular bark is observed treat it in the following manner:—By means of a tool with a sharp scraping edge carefully scrape off the outer bark over the affected area and for about six inches all round outside it. The scraping should take off the dark-coloured outer tissue and the green layer immediately beneath it, so that about one-third of the thickness of the bark is removed. The scraped area can then be treated with a one-in-six (approximately 3 per cent. polysulphide content) lime-sulphur solution.

Within three to six months after treatment the outer layers should slough off and expose new and healthy bark. All trees should be examined at intervals for the extension of old lesions or the development of new ones and be promptly treated if necessary.

When the lesions on a tree are large or numerous it is likely that the disease has become systemic, and scraping cannot then be expected to effect a complete cure. In this case it is best to remove and burn the affected tree.

EXANTHEMA.

In pronounced cases exanthema shows up with a flush of new growth, the branches of which are sometimes curved at the ends and bear abnormally large dark-green leaves. Later a dark-brown deposit of a resinous material appears along the twigs, and the shoots gradually turn yellow and die back. Blister-like gum pockets, multiple buds, and very angular stems are other characteristics associated. In less definite cases there may be a multiplication of the terminal branchlets and a shortening of the internodes to give a bunched appearance to the tree as a whole. The crop from a diseased tree is usually poor, as a result of the fruit dropping while immature, and from the development of dark-brown superficial spots or blotches accompanied by a hardening of the skin, which often leads to cracking. (Plate 41, fig. C.)

Exanthema is apparently not dependent on the presence of parasitic organisms for its development. The exact cause remains undetermined, although recent work suggests that it may be due to an insufficient supply of copper to meet the normal needs of the tree. In Queensland the disease is usually associated with very light, sandy soils lacking in humus. It is aggravated by poor drainage and hard pan.

Control.

Remove all dead and dying wood. Improve the soil conditions by manuring, with a bulky farmyard manure if procurable, and by ploughing in green crops. Drain the land if necessary. A relatively quick cure may often be obtained by the application of bluestone (copper sulphate). This may take the form of a Bordeaux spray, for which the normal melanose and scab spray applied at blossoming time is suitable, or the bluestone crystals may be chipped in round the tree, using from 1 to 2 lb. per tree, depending on size. Results should become obvious twelve months from the date of application.

MOTTLE LEAF OR FOLIOCELLOSIS.

As the name suggests, this disease is characterised by a mottled condition of the foliage. This is due to the development of irregular, yellow, chlorotic areas between the main veins of the leaf. These areas vary greatly in size and in some cases the normal green colour is

entirely absent except in the immediate vicinity of the large veins. According to the severity of the disease the foliage may be otherwise normal or there may be a marked stunting in growth with the formation of a small narrow type of leaf. The fruit produced on branches affected in the latter manner are often greatly reduced in size and tend to yellow prematurely.

There is still doubt as to the exact cause of mottle leaf. It is apparently, like exanthema, a physiological disease brought about by a disturbance in the normal nutrition of the tree. Recent work on mottle leaf and on an allied disease of deciduous fruits suggests that it may be due to a shortage in the amount of zinc available to the plant. This is probably connected with the intimate relationships existing between the smaller citrus roots and certain microorganisms of the soil. In Queensland the disease is most serious in the light sandy soils of the drier inland districts.

The control of mottle leaf is still in an experimental stage, the subject being under investigation both here and abroad. Best results have so far been obtained by applying zinc sulphate either as a soil dressing or a spray or by a direct injection of zinc or zinc compounds into the branches. Owing to the present lack of knowledge, and a danger of injury to the treated trees, the spray method is the only one which can be suggested for trial at present. A spray consisting of 10 lb. zinc sulphate, 5 lb. hydrated lime, in 100 gallons water should be applied in the early spring and again, if the disease is severe, in the autumn.

The production of an extensive and efficient root system by correct manuring, especially with bulky organic manures, and whenever possible by irrigation in dry periods, is an important adjunct to the above treatment.

COLLAR ROT AND GUMMING.

The lemon or lemon stock, especially in coastal districts, is particularly subject to collar rot and gumming, as are, to a less extent, the mandarin and sweet orange. The first indication of the presence of this disease is a yellowing or unhealthy appearance of a section of the foliage accompanied, perhaps, by excessive flower formation. Examination of the base of the trunk or one of the main branches discloses a dark, water-soaked area, from which gum drops are often exuding. The bark over this region can be readily lifted, and between it and the wood is a slimy, gum-like substance. Extension of this lesion will gradually ringbark the trunk or branch affected. Less frequently the lemon may develop gumming areas even on the smaller branches.

To lessen the risk of infection the soil should be kept well pulled away from the base of the tree, and care should be taken to avoid injury during cultivation. If noticed before it has advanced too far, the disease may be cured by surgical methods. If the crown and main roots are affected, open them up to the sun and air. Carefully remove the whole of the diseased bark and wood by cutting or scraping well back into sound tissue with a sharp instrument. Collect and burn the scrapings. Paint the wound with Bordeaux paste.

If a lemon is neglected until most of the limbs are affected it may be necessary to consider replanting. When soil or locality are unsuitable this state usually eventuates after some years.

When collar rot is the result of the use of a susceptible stock, inarching with one less susceptible may be considered worth while.

ARMILLARIA ROOT ROT.

The tree affected by this disease exhibits symptoms similar to those associated with collar rot. That is to say, there is a yellowing of the foliage of the whole tree, or one of its branches, together with some dieback. If, on examination, no gumming is found, the larger roots should be opened up and examined. If Armillaria root rot is present, shiny, black, string-like, fungal strands will be seen twining themselves about the roots or lying partly embedded in the bark, which is soft, easily stripped off, and has a strong mushroom odour. (Plate 42, fig. A.) The black strands belong to one of the mushroom-like fungi (*Armillaria mellea*), which grows on rotting stumps or roots left in the ground after clearing, and from these passes to a living citrus root should one come in contact.

The disease may be largely prevented by having all stumps and roots removed from land which is to be used for orchard purposes, and, if time is not a factor, by growing an annual crop for a year or more prior to planting trees.

Expose the main roots to the beneficial action of sun and air for as long as the absence of frosts will permit. Remove any badly-rotted roots and treat those partly affected by carefully scraping and painting, as advised for collar rot.

Remove and burn the original stump or root from which infection started if this can be located.

The affected area is best isolated to prevent further spread of the fungus to healthy trees by digging a trench two feet deep round the outside of the furthest root extension of the ones attacked, throwing the soil to the inside.

SOOTY MOULD.

Sooty mould is a conspicuous, though in itself relatively unimportant, disease of citrus. The black, sooty deposit covering the foliage and often the fruit of affected trees is well known to most citrus-growers. An examination of the leaves will show the sooty appearance to be due to a thin, black, superficial film, which may be easily scraped off in flakes. This film is formed by the close interlacing of the dark threads of various fungi, of which the chief are species of *Capnodium*. These fungi are not plant parasites, but live on the sugary secretion of certain scale insects, of which the more important ones concerned are the pink and white wax scales and the lecanium or soft scales.

The fungus is entirely superficial in its growth, and does not directly injure the tree, although the presence of the film of mould may tend to weaken it by the exclusion of light and air.

Control.

To rid a tree of sooty mould, it is necessary to destroy the scale insects, on whose secretion the fungus is dependent for its existence. Specimens of the scale insects present should be forwarded to the nearest entomologist in order that advice may be obtained on the best method for their control. If it is desired to remove the mould quickly after destroying the scale, spray the tree with a thin paste made by boiling flour in water. When this dries it will flake off, carrying away the mould in the process.

SMOKY BLOTCH.

Smoky blotch is the name given to a disease which has become prevalent in coastal citrus orchards during recent years. A diffuse smoky discolouration on the skin gives a dull, dirty appearance to the fruit as it approaches maturity. In contrast to sooty mould this discolouration is light-brown rather than black and consists of a very thin surface film which can be rubbed off only with difficulty. It is formed by the fine interlacing threads of the fungus *Leptothyrium sp.* Local aggregations of these threads to form resting and fruiting bodies may produce scattered black specks over the rind. This has given rise to the name of fly speck in some countries, but it is a stage not commonly in evidence here.

The application of fungicides for the control of other citrus diseases should check smoky blotch as well. The resin-soda-fish oil spray is also reported to exercise some control.

QUEENSLAND SHOW DATES FOR 1937.

February.

Pittsworth's Bushmen's Carnival	1st
Stanthorpe	3rd to 5th
Warwick	8th to 10th
Killarney	12th and 13th
Clifton	23rd and 24th

March.

Allora	3rd and 4th
Amiens	6th
Goombungee	11th
Milmerran	19th
Pittsworth	23rd and 24th
Tara Show and Campdraft	24th and 25th
Boonah Campdraft	29th

April.

Oakey	7th and 8th
Toowoomba Royal	12th to 15th
Dalby	21st and 22nd

May.

Longreach	3rd to 6th
Beaudesert—	
Show	5th and 6th
Bushmen's Carnival	7th and 8th
Wallumbilla	6th and 7th
Nanango	6th and 7th
Dirranbandi	6th to 8th
Ipswich	11th to 14th
Wowan—	
Show	13th and 14th
Rodeo	15th
Crow's Nest	12th and 13th
Biggenden	20th and 21st
Gympie	20th to 22nd
Warrill View	22nd
Kilkivan	24th and 25th
Maryborough	25th to 27th
Charleville	25th to 27th

May—continued.

Maryborough	25th to 27th
Gin Gin	28th and 29th
Toogoolawah	28th and 29th
Kalbar	29th
Childers	31st May and 1st June

June.

Bundaberg	3rd to 5th
Lowood	4th and 5th
Boonah	9th and 10th
Gladstone	9th and 10th
Rockhampton	22nd to 26th
Marburg	18th and 19th
Mackay	28th June to 1st July

July.

Bowen	7th and 8th
Ayr	9th and 10th
Rosewood	9th and 10th
Cleveland	9th and 10th
Townsville	13th to 15th
Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th and 21st
Laidley	21st and 22nd
Cairns	27th and 28th
Gatton	28th and 29th
Caboolture	30th and 31st
Maleny	22nd and 23rd

August.

Royal National, Brisbane	16th to 21st

September.

Imbil	3rd and 4th
Rocklea	11th
Innisfail	17th and 18th

Principles of Botany for Queensland Farmers.

C. T. WHITE, Government Botanist.

[*Continued from page 48, January, 1937.*]

CHAPTER XXIV.

Dicotyledons.

Subclass Metachlamydeæ or Sympetalæ.—Perianth in two whorls or series, the inner (corolla) is gamopetalous and the stamens are often epipetalous, i.e., attached to the corolla and appearing as outgrowths from it.

FAMILY SAPOTACEÆ.

A family of trees often with a milky juice. Leaves simple, alternate. Flowers usually hermaphrodite, borne in the leaf-axils or on the older wood below the leaves, sometimes solitary, usually clustered. Calyx of 4-8 segments or sepals. Corolla divided into lobes or teeth, which may be the same number as or double the number of sepals. Stamens the same number as the petals or twice as many, often, in addition alternating with staminodia and scales. Ovary superior. Fruit a berry or drupe.

The family is widely distributed over the tropics and sub-tropics of the world. About twenty species are natives of Queensland. These include two known as Milky Plum (*Niemeyera*) and the Black Apple (*Sideroxylon australe*), Cairns Pencil Cedar (*Lucuma galactoxyla*), and the Wongi (*Mimusops Browniana*), the last an important native fruit to the natives of Torres Strait.

A cultivated fruit sometimes seen in Queensland is the Sapodilla (*Achras Zapota* or *Sapota*), a native of Tropical America. It is also the chief source of the chicle gum from which chewing gum is manufactured. Other fruits belonging to this family but which I have not seen here are the Mammee Apple (*Calocarpum mammosum*) and the Star Apple (*Chrysophyllum cainito*), both natives of tropical America.

FAMILY EBENACEÆ.

A family of trees closely allied to Sapotaceæ, but with a watery, not milky, sap, and the flowers mostly unisexual, not hermaphrodite. Leaves simple, alternate. Flowers axillary, the males in cymes or clusters, the females usually solitary. Stamens 8-20 in the males, fewer and sterile in the females. Ovary superior. Fruit a berry.

The family is a small one widely spread over the tropical and sub-tropical regions of the world. It is represented in Queensland by about fifteen species, mostly small or medium-sized trees. The wood of trees of the *Ebenaceæ* is often hard and black, as in the commercial Ebonies, *Diospyros Ebenum* and *D. melanoxylon,* of India. The Queensland Ebony (*Diospyros humilis* or *Maba humilis*) possesses a wood equal in quality to the imported ebonies, and can be used for billiard cue inlay, piano keys, chess men, and general turnery.

The family includes a few cultivated fruits, the most important being the Persimmon (*Diospyros Kaki*), a native of China and Japan. Another is the Mabolo (*Diospyros discolor*), a native of the Philippines,

sometimes seen in cultivation in North Queensland; it possesses a brownish, hairy outer rind and a white or brownish pulp.

Family Oleaceæ (Olive Family).

A family of trees or shrubs or woody climbers chiefly characterised by simple, opposite leaves, and flowers with only two (very rarely

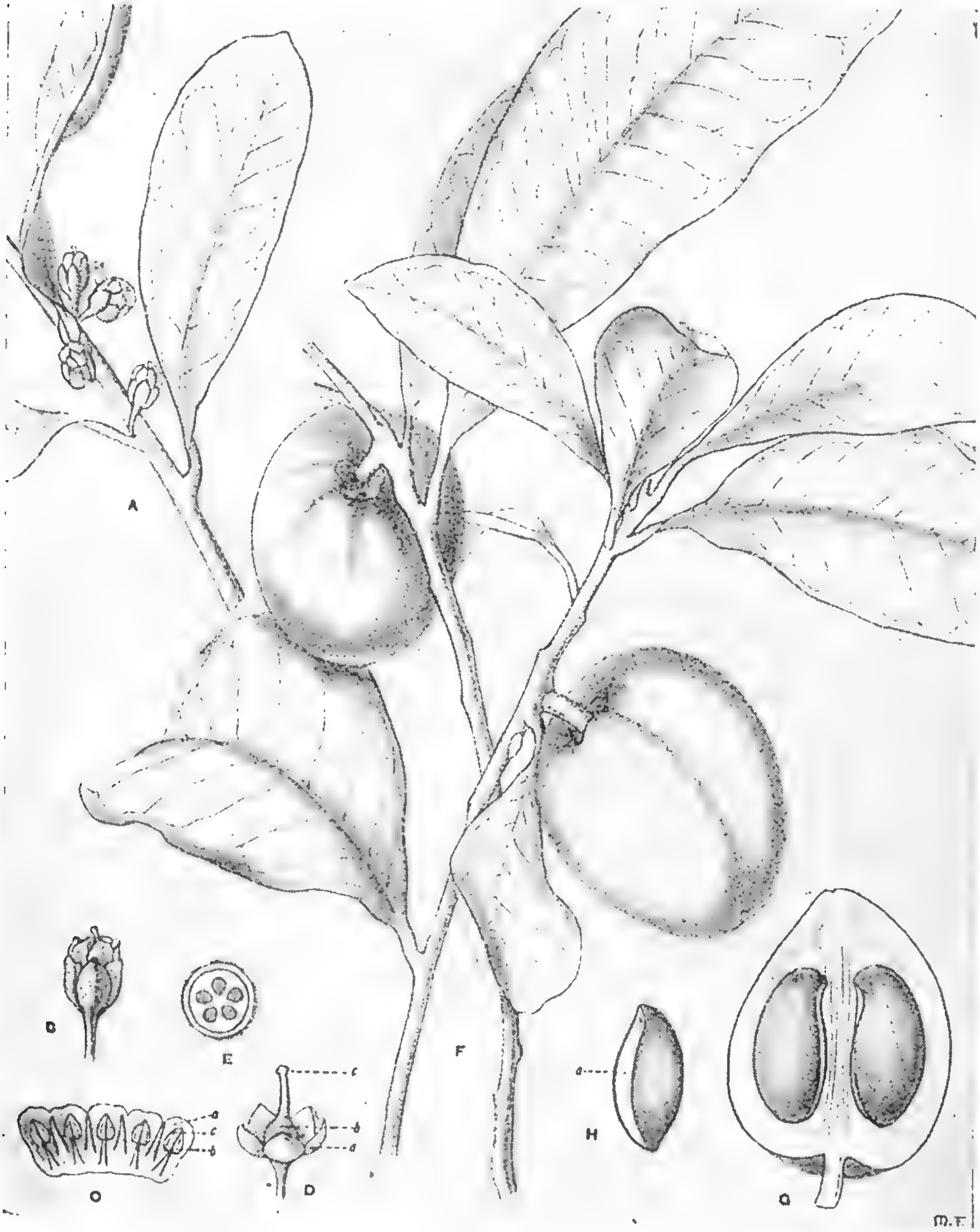

Plate 43.

Black Apple (*Sideroxylon australe*)—Family Sapotaceæ.

A. Flowering twig. B. A single flower. C. Corolla and stamens laid open—*a.* Corolla lobe; *b.* stamen; *c.* staminode. F. Fruiting branches. G. Fruit in longitudinal section. H. Seed; *a.* Hilum.

four) stamens. Flowers mostly in panicles. Calyx composed of 4-5 sepals, teeth, or lobes. Corolla with 4 to sometimes numerous lobes. Ovary superior. Fruit mostly a drupe.

A family widely spread over the world. It is represented in Queensland by eighteen native species, none of any particular economic importance. Among cultivated trees the most important is the Olive (*Olea europæa*). Several Jasmines (genus *Jasminum*) are grown in Queensland gardens.

FAMILY LABIATEÆ (THE LABIATES).

A family of herbs or shrubs, usually aromatic, branches mostly more or less 4-angled. Leaves opposite or whorled. Flowers in cymes, the cymes arranged in whorls in the leaf-axils. Calyx 5-toothed or 2-lipped. Corolla with a distinct tube and the limb divided into an upper and lower "lip," rarely the limb more or less regular and 5-lobed. Stamens 2 or 4. Ovary 4-lobed. Fruit enclosed in the calyx and composed of 4 small, seed-like nuts.

A large family finding its greatest development in the temperate regions of the world. It is well represented in the Queensland Flora by about forty-five native species and several naturalised weeds. Two of these latter, the Stagger Weed (*Stachys arvensis*) and Dead-nettle (*Lamium amplexicaule*) are known to cause staggers or shivers in working stock or stock that have been driven or excited. Ordinary resting paddock stock such as dairy cattle seem to eat the plants with impunity. Strange to say, in Europe and North America, where these plants are common farm weeds, no trouble seems to be experienced from them. A comparatively recent introduction that has caused some concern on account of its difficulty of eradication and poisonous properties is the Wild Mint (*Salvia reflexa*), a native of the Western United States naturalised in Queensland. The name "Wild Mint" is also applied to *Stachys arvensis*, and a good deal of confusion exists between the two weeds. The native Pennyroyal (*Mentha satureioides*) and the naturalised Wild Salvia (*Salvia coccinea*) are reported to cause abortion in cattle.

The family includes a number of culinary herbs as—Sage (*Salvia officinalis*), Marjoram (*Origanum Marjorana*), Thyme (*Thymus vulgaris*), &c. Garden Mint or Spear Mint is *Mentha viridis*, peppermint is *Mentha piperita*, and Bergamot Mint *Mentha citrata*. This last is frequently grown in Australia under the name of Eau-de-Cologne Plant.

FAMILY SOLANACEÆ.

A family of herbs, shrubs, climbers, or soft-wooded trees. Leaves alternate, simple (often deeply lobed and divided, but not truly compound). Flowers solitary or in cymes or 1-sided racemes. Calyx with 4-10 sepals, or toothed or lobed. Corolla 5- (rarely 4-) toothed or lobed. Stamens the same number as the corolla lobes and alternate with them. Ovary superior. Fruit a berry or capsule.

A large family widely spread over both the temperate and tropical regions of the world. It is represented among native plants by almost sixty species, the vast majority of which belong to the genus *Solanum*. Among native plants members of the genus *Duboisia* attain tree size. *D. myoporoides*, the Poisonous Corkwood, is a small soft-wooded tree. The leaves are very poisonous, and cases are on record of children being

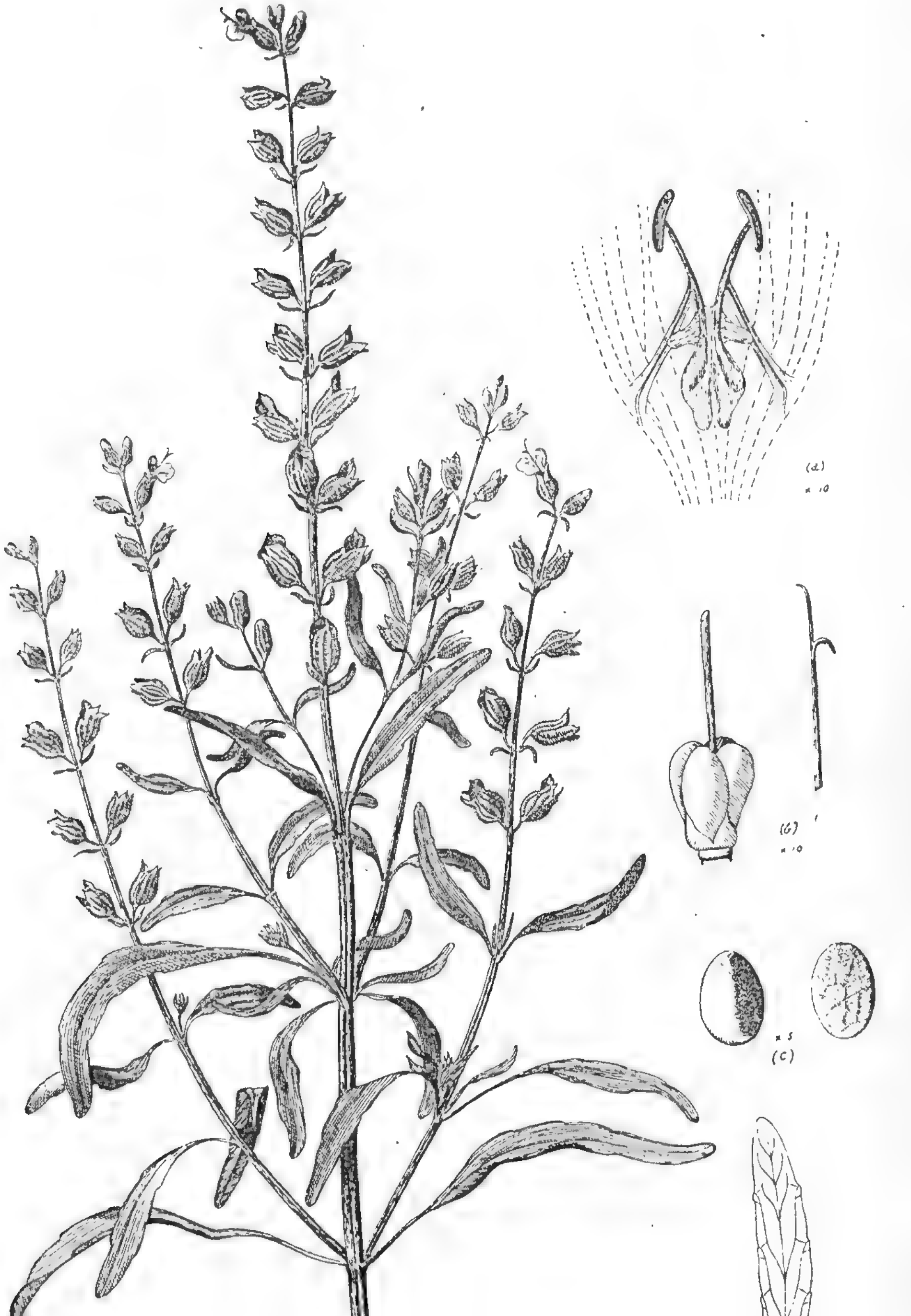

Plate 44.

Salvia reflexa.—Narrow-leaved Sage, Wild Mint, or Mint Weed (Family Labiatæ). A.—Stamens showing the broad and lobed nature of the lower connective (a character of the species). B.—Pistil showing 4-lobed ovary and 2-lobed style (one lobe much longer than the other). C.—"Seeds."

Plate 45.
SOLANUM AURICULATUM—Wild Tobacco (Family Solanaceæ). A very common second-growth weed in coastal Queensland.

fatally poisoned through sucking a few of the leaves. The leaves contain a mixture of midriatic alkaloids, on which account they have been exported to Germany and England. The demand for the leaf, however, has been erratic. *D. Leichhardtii* is an allied species very common in parts of the Southern Burnett District, particularly between Kingaroy and Nanango. The third species, *D. Hopwoodii,* is the Pituri, well known as a narcotic in use among the aborigines. It is only found in Queensland in the extreme south-west . It is abundant in Central and Western Australia, and is fairly common along parts of the Trans-Australian Railway.

The family contains several imported weed-pests, some of which are poisonous to live stock. A frequent weed of cultivation is *Datura stramonium,* the common Stramonium or Thorn Apple. It has rather a nauseating odour and taste in the green stage, and the living plants are rarely eaten by stock. Several cases, however, are on record where the plants have been cut and chaffed with the standing crop and subsequently fed to animals with fatal results. The leaves are dried for use as a tobacco by sufferers from asthma. Several other weeds of the same genus are naturalised in Queensland, and all possess similar poisonous properties.

The family contains some very important economic plants. Among them are the Potato (*Solanum tuberosum*), Egg-fruit (*Solanum Melongena*), Tomato (*Lycopersicum esculentum*), Capsicums or Chillies (*Capsicum annum,* annual species and *C. frutescens,* shrubby, perennial species), and Tobacco (*Nicotiana Tabacum*). It includes several important drug plants as Belladonna or Deadly Nightshade (*Atropha Belladonna*) and Henbane (*Hyoscyamus niger*).

Family Rubiaceæ.

A family of trees, shrubs, herbs, or climbers. Leaves opposite or sometimes whorled. Stipules interpetiolar (see p. 227). Flowers mostly arranged in cymes, sometimes solitary. Calyx-tube adnate to the ovary, limb entire or with several teeth or divisions. Corolla 3-5-toothed or lobed. Stamens as many as the corolla lobes and alternating with them. Ovary inferior. Fruit various—a drupe, berry, capsule, or indehiscent nut.

A large family widely spread over the world but finding its greatest development in tropical regions. It is well represented in the Queensland flora, though none of the species are of particular economic importance. It contains the coffee (*Coffee arabica* and to a less extent *C. robusta*) and Quinine (*Cinchona* spp.).

Family Compositæ (The Composites).

A family mainly of herbs, sometimes shrubs or climbers, rarely trees. Leaves simple but sometimes very much cut and divided, opposite or alternate. Flowers arranged in heads, surrounded by an involucre of bracts either in a single or in several series (see Plate 155, page 362, figs. 2 and 3). Calyx wanting or converted into a *pappus,* usually consisting of plumose hairs, sometimes of scales or barbs. Corollas tubular or ligulate. (In Plate 46, fig. A represents a ligulate and fig. B a tubular corolla, respectively). Stamens 5 (rarely 4), the anthers united in a sheath round the style.* Ovary inferior. Fruit a small, seed-like nut or achene, crowned by the pappus or naked.

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* In the Noogoora Burr and Bathurst Burr (genus *Xanthium*) and in the Wormwood and Rag Weeds (genus *Ambrosia*) the anthers are distinct. These plants are regarded by some botanists as constituting a distinct family—the Ambrosiaceæ—apart from the Composites.

Plate 46.

WILD SUNFLOWER OF AMERICA OR DOGWEED (*Verbesina enceliodes* Benth. et Hook). Family Compositæ. A.—Ray floret. B.—Dish floret. C.—Involucral scale.

A very large family widely spread over the world. It is strongly represented in the Queensland flora by over 200 species. Many are common naturalised weeds—*e.g.*, Billy Goat Weed (*Ageratum conyzoides*), Mist Flower (*Eupatorium riparium*), Horse Weed (*Erigeron linifolius*), Cobbler's Pegs (*Bidens pilosa*), Noogoora Burr (*Xanthium spinosum*), Federal Weed (*Erechthites valecianæfolia*), Jo Jo Burr (*Soliva sessilis*), Stinking Rodger (*Tagetes glandulifera*), Milk Thistle (*Sonchus oleraceus*), Flat Weed (*Hypochæris radicata*), Dandelion (*Taraxacum officinale*), &c.

Part V.—PLANT GEOGRAPHY AND ECOLOGY.

Plant Geography has for its study the distribution of plants over the surface of the earth. *Ecology* is a branch which has come much to the fore in recent years, and concerns itself with the study of the individual plant or of particular groups of plants in relation to their environment.

CHAPTER XXV.

The Plant Associations of Queensland.

The vegetation of the world has been roughly classified by botanists into the three main divisions of Grassland, Woodland, and Desert. Of these only the first two occur in Queensland. We have, it is true, country popularly called desert, but in reality this is a form of woodland, as it not only contains various grasses and herbage, but small trees and shrubs. What is called desert in Queensland, as a matter of fact, possesses a varied flora, and is extremely interesting country from the point of view of the botanist.

The Grass Lands or Pastures.

Natural grasslands of very extensive range are represented in Queensland by the rolling downs formation and covered by Mitchell, Flinders, and other grasses and herbage characteristic of Western parts of the State.

These pastures are of a sufficiently high standard to be famous throughout Australia. Of the grasses composing the pastures the best known are the Mitchell Grasses, Flinders Grasses, native Panic Grasses, Blue Grasses, better-class Star Grasses, Love Grasses, &c. Here and there on the Darling Downs and in the Granite Belt Danthonia Grasses, such as *Danthonia pallida*, *Danthonia racemosa*, and *Danthonia longifolia*, are of some importance, though not nearly to the same extent as they are in the colder places further to the south, such as the New England Tableland. Annual herbs following the summer rains are a feature of much of the grass land. These belong to a great range of families, the Amaranths, the Saltbushes, the Legumes, and the Mallows being among the most valuable.

MITCHELL GRASSES.

Now, to deal with some of the grasses individually. Undoubtedly the grasses most associated with Australia, both in the country itself and abroad are the Mitchell Grasses. The Barley Mitchell Grass (*Astrebla pectinata*) was found by Sir Thomas Mitchell near Condobolin and on the plains of the Bogan in New South Wales in 1836. These were described at the time by the great English botanist, Charles

Lindley, as *Danthonia pectinata,* and are to be found preserved at the present time at the Museum and Herbarium of the Department of Botany of the University of Cambridge, England. Though Mitchell is generally regarded as the discoverer of Mitchell Grass, specimens had already been collected by both Cunningham and Fraser as early as 1817, though, apparently, they remained undescribed and, indeed, unrecorded at all until C. E. Hubbard, when monographing the genus, found the specimens at the British Museum of Natural History, London. The Mitchell Grasses are widely spread over the heavy blacksoil plains of Northern Australia, Central Australia, Queensland, and New South Wales, but find their greatest development in Queensland. The genus is confined to Australia. Four distinct species are to be recognised:—

1. *Astrebla pectinata,* often known as the Common Mitchell, is the commonest form in New South Wales, but is comparatively rare in Queensland. It has a wide distribution through Central Australia to Western Australia, but in the lastmentioned State is, I understand, very rare.

2. *Astrebla lappacea,* known as the Wheat-eared or Curly Mitchell. This is the form most abundant in Queensland. Like the Common Mitchell, it has a wide distribution, but is nowhere so abundant as in Central Queensland. It has a long, wheat-eared seed-head, and is probably the most important species of the genus from an economic standpoint. In the older literature it is referred to as *Astrebla triticoides,* but this excellent specific name has, unfortunately, to give way on account of priority to *Astrebla lappacea.* This latter name was used by Lindley as far back as 1848, when he named the grass *Danthonia lappacea,* based on specimens collected by Sir Thomas Mitchell, near Mitchell, Queensland, in 1846.

3. *Astrebla squarrosa* is the Bull Mitchell, moderately common in parts of Central and North Queensland, also found in the Northern Territory and the north-west of New South Wales. It is a coarse species not occurring in such quantities as *Astrebla lappacea,* and not regarded as the equal of the common *Astrebla lappacea* as a stock grass. It yields a very large seed-head and a correspondingly large grain.

4. *Astrebla elymoides.*—This is variously known as the Hoop Mitchell, Wire Mitchell, and Weeping Mitchell. It is very distinctive looking from all the others, and has a wide distribution through the north-west of Western Australia, Northern and Central Queensland to New South Wales. It is quite a good fodder grass, very drought-resistant, but suffers in comparison with its better relatives.

FLINDERS GRASSES.

Ranking next in importance to the Mitchell Grasses in the eyes of the pastoralists of Northern and Western Queensland are the Flinders Grasses, of which seven distinct kinds have now been recognised. They all belong to the genus Iseilema, which is composed, so far as known, of twelve species, five of which are found in tropical Asia and seven in Australia. Until recent years all the Australian kinds were looked upon as forms of one species. During the summer months of 1909-1910, the Czecho-Slovakian botanist, Dr. Karel Domin, botanised extensively in Queensland, and he paid special attention to the grasses, making extensive collections. He recognised four distinct species among the grasses known collectively as Flinders Grass. Later, C. E. Hubbard, an English botanist, and probably the leading grass systematist of the world, spent

twelve months' work in Queensland. He has recently monographed the genus and recognised seven distinct species. The value of Flinders Grasses lies in their peculiar habit of growing extremely palatable and nutritious in the form of standing hay, in this respect differing from practically all other grasses. The nutritive value is due to the amount of grain produced and the peculiar way in which it is borne among small leaves over almost the whole plant. The Flinders Grasses are extremely brittle when dry, but all stock greedily lick up the broken

Plate 47.

Bull Mitchell Grass (*Astrebla squarrosa*) in a slight depression on plain at Claverton, between Charleville and Cunnamulla. The tussocks are evident. In the foreground seed-heads of the grass are seen.

[*Photo. by W. D. Francis.*

Plate 48.

The stock route on the Ward Plain, about 12 miles north-west of Charleville. The vegetation shown in the foreground consists of low-growing Salt Weed (*Threlkeldia proceriflora*) and two low-growing burr-bearing plants (*Bassia echinopsila* and *B. anisacanthoides*).

[*Photo. by W. D. Francis.*

pieces and do well on them. As a hay crop for dry tropical and sub-tropical regions with a short summer rainfall season, the Flinders are probably unequalled, making up in high nutritive value what they lack in bulk.

BLUE GRASS.

Extremely important on the Downs country of Queensland and New South Wales, and particularly in this State, is the Blue Grass *(Dichanthium sericeum)*, in its typical form distinguishable in the field by its bluish-green colour, luxuriant appearance, and soft silky seed-heads. A number of forms are distinguishable, and they are at present under review by Mr. C. E. Hubbard, whose classification of them is looked forward to by botanists and agrostologists. One may say: "Why worry about the finer points of the classification of these grasses at all? Where does it lead?" But surely it is hardly necessary to point out that a good sound botanical classification is the basis on which all future work on the improvement of the grasses by selection and hybridisation rests. Blue Grass has an exceptionally high reputation as a fodder among pastoralists. It is usually one of the earliest grasses to shoot in response to spring and early summer rains, but is not particularly drought-resistant. It makes one of the best hays possible, and as it produces an abundance of seed it is worthy of study from the agrostologist and plant breeder. E. Breakwell, in his excellent book on "The Grasses and Fodder Plants of New South Wales," states that it has been found that the smallest and plumpest spikes produce the best seed.

PANIC GRASSES.

Forming a very large percentage of the bulk of the average native mixed pasture are the various sorts of Panic Grasses. These were all included in the earlier works on Australian grasses under the genus Panicum. This genus has now, however, been divided into numerous smaller genera, the genus Panicum itself, in a restricted sense, being comparatively small, and including, for the most part, grasses with wide-spreading, much-branched seed-heads, such as *Panicum decompositium*, often referred to as Native Millet, *Panicum trachyrachis*, Coolibah Grass, *Panicum prolutum*, Coolah Grass, and a number of others, common enough in the pasture but lacking distinctive local names. As at present understood, twenty different kinds of Panicums, or Panic Grasses proper, are found in Queensland.

PASPALIDIUM GRASSES.

Of the grasses split off from the Panicums by modern botanists are those forming a group now known as the Paspalidium Grasses. Paspalidium is a small genus of about sixteen species, of which ten are found in Australia, all the Australian species being found in Queensland, though many extend to New South Wales and the Northern Territory. They are remarkable for the great amount of grain they carry in narrow, spike-like heads. Most of them are extremely palatable. The largest is *Paspalidium globoideum*, known as Shot Grass or Sago Grass in Queensland. It grows 3 feet to 4 feet high or more, is extremely palatable to stock, and bears a sago or tapioca-like grain. This grain is borne in great abundance, and is one of the staple foods of the grain-eating birds in the West; in fact, one pastoralist, Mr. J. Garvey, of Fernlees, Central Queensland, in sending specimens of this grass along with other Paspalidiums stated that that the budgerigars

fed so heavily on the seed that the grass did not get a chance to establish itself properly. This does not, of course, apply only to this particular grass but to others, including the Mitchell Grasses, &c. Among the smaller growing Paspalidiums are several known as Brigalow Grasses. A good deal of prominence has been given to one of these (*P. cæspitosum*) in the Queensland Press, and following this a good deal of interest has been focused on this particular grass and its allies.

Paspalidium flavidum is a large species intermediate between the smaller Brigalow Grasses and the Shot Grass or Sago Grass (*Paspalidium globoideum*). Of the Brigalow Grasses proper we can now, I think, recognise at least three distinct species, namely:—*Paspalidium gracile, Paspalidium distans,* and *Paspalidium caespitosum.* At the present stage of our knowledge I do not care to state which is the best. Probably the values are more or less similar; but, in any case, they represent a very fertile field for intensive work by agrostologists in the future.

Many other grasses go to make up the mixed native pasture—Love Grasses, Kangaroo Grasses, Oat Grasses, Star Grasses, &c.—but time does not allow to deal with these in any detail. However, farmers, pastoralists, and others are invited once more to forward specimens of grasses and herbage to the Department for identification and report.

FOREST GRASSES.

Though scarcely grassland in the strict botanical sense, but rather an undergrowth in the open or savannah forest, it might be convenient to treat the forest grasses and herbage here. Excellent cattle pasturage exists along much of the coastal portions of the States. Typical tropical savannah forests, consisting of low eucalypts, wattles, Proteaceae, and other trees with an undergrowth of grasses and herbage, are found over much of the Cape York Peninsula, improving as one comes south to the Gulf country, where a great mixture of grasses and herbage occurs in the pastures, grass genera represented being *Andropogon, Aristida, Arundinella, Alloteropsis, Chloris, Chrysopogon, Cynodon, Ectrosia, Eragrostis, Eriachne, Panicum, Pappophorum, Paspalum, Rottboellia, Setaria, Sorghum, Themeda,* &c.

Southward from Ingham, through Townsville to Proserpine, there is a "dry" belt; the native pastures are mostly coarse in appearance, and, in a lot of the open forest country, Blady Grass *(Imperata)* and Spear Grass (*Heteropogon*) predominate. During the wet season some of the larger grasses, such as the Tall Spear Grass *(Heteropogon triticeus*), the native Sorghums (*fulvum, australe,* and *laxiflorum*) grow to a great height—8 to 10 feet—or even more. Some of the best pastures in the open Eucalyptus are composed of Kangaroo Grass *(Themeda)* almost in a pure stand.

Of recent years anywhere near a settlement, *Chloris barbata,* noticeable on account of its purple heads, has become the outstanding grass in the native pastures. It has been highly spoken of, but it is rather doubtful if it has any very great value.

The common tropical weed *Stylosanthes sundaica* (Wild Lucerne) has spread everywhere, greatly improving the pastures. Cattle are very fond of this leguminous plant, and analysis shows its feeding value to be high. Unfortunately it is only of annual duration, and dies out on the approach of the dry winter months.

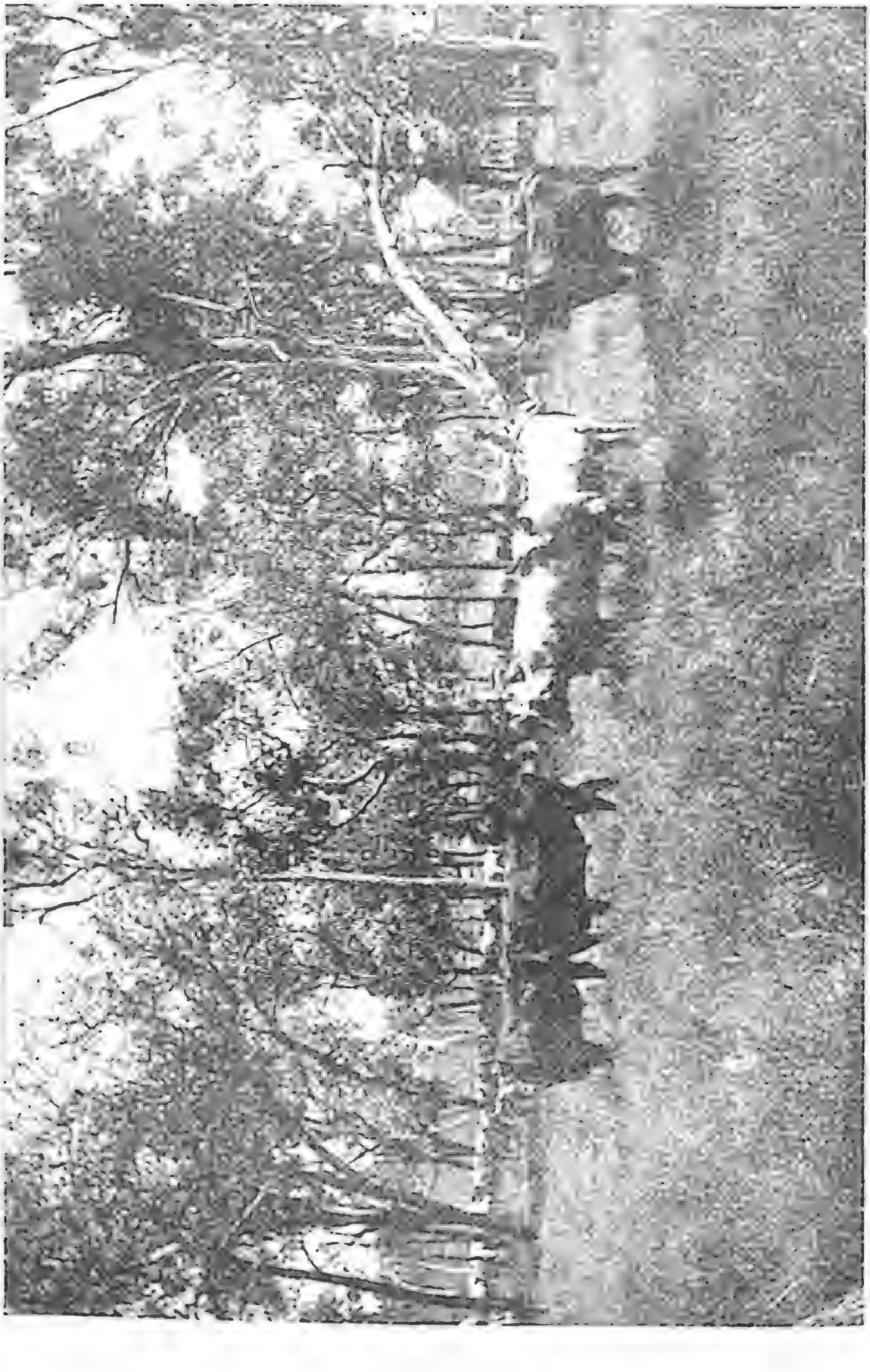

Plate 49.

Typical grass-land forest (Savannah forest or parkland), Taabinga. Beef cattle in foreground.

From Proserpine southwards to Koumala the rainfall is high, but this is essentially sugar country and stock-raising is of little consequence; but from Koumala southwards to about Gladstone is another "dry" belt. In the more northern portions the pastures are much the same as those between Ingham and Proserpine, except that conditions are a little less tropical, and *Stylosanthes* is not a predominating feature in the summer pastures. As one comes south the pastures differ considerably, carrying in many cases a very heavy mixture of species, though they suffer severely from continued dry spells, particularly in the winter and spring months. The principal grasses composing the pastures are *Dichanthium* spp. (Blue Grasses), *Themeda* (Kangaroo Grasses), *Alloteropsis* (Cockatoo Grass), *Chloris* spp. (Star Grasses), *Cynodon* spp. (Couch Grasses), *Eragrostis* spp. (Love Grasses), *Eriochloa* spp., *Panicum* spp. (Panic Grasses), *Pappophorum* spp. (Whiteheads), *Sorghum* spp. (Native Sorghum), *Setaria* spp. (Native Millets), *Sporobolus* spp., &c.

In some parts of Central Queensland, such as the Dawson Valley, native pastures are those of the coastal type, except that some of the better Western grasses such as the Mitchell Grasses *(Astrebla* spp.) Flinders Grasses *(Iseilema* spp.), and some of the better Panic Grasses intrude.

From Gladstone southwards the native pastures vary in quality from good to very poor. In the better pastures Kangaroo Grass (*Themeda*), Blue Grass (*Dichanthium*), *Chrysopogon* spp., Love Grasses (*Eragrostis* spp.), and Native Panic Grasses (*Panicum* spp.) predominate. In the poorer pastures, particularly those on sandy or clayey soils, Spear Grasses (*Aristida* spp.) and a general mixture of varying poorer sorts compose the bulk of the pasture.

In the Burnett, Lockyer, and Brisbane Valley areas, the better open Eucalyptus country supports native pastures for the most part of a high order, consisting of a general mixture of Blue Grasses, Panic Grasses, Kangaroo Grasses, &c. Herbaceous plants comprising a fair number of legumes are also a feature of these pastures. A good deal of the country has suffered badly from overstocking, with the consequence that the better mixtures have been eaten out, leaving in many cases almost a pure stand of the Bitter Blue Grass (*Bothriochloa decipiens)*, a very inferior species. The poorer pastures consist mostly of Blady Grass (*Imperata*), Barb-wire Grass (*Cymbopogon refractus*), Spear Grasses *(Heteropogon* and *Aristida* spp.), Burr Grass *(Cenchrus)*, &c.

An interesting feature has been the alteration in some localities—particularly near Brisbane—of the composition of the native pasture. In most cases this has deteriorated through overstocking, but in many cases, especially in the better forest (Eucalyptus) soils, the original mixture has given way to pastures almost entirely composed of the Blue Couch (*Digitaria didactyla*) and here and there in similar areas the Common Couch (Cynodon), and this possibly has improved the carrying capacity of the pastures. Both Couches are regarded as native grasses, but it is only of comparatively recent years, about the last twenty, that the Blue Couch seems to have come into any prominence.

Fresh Water Grasses.

A distinct type of pasture in coastal Queensland are fresh-water swamp pastures of a high grazing value. In these the following grasses

are the most important:—Water Couch *(Paspalum distichum),* White Water Couch *(Panicum obseptum),* Rice Grass *(Leersia hexandra), Hemarthria compressa,* Native Millet *(Echinochloa),* and a few others of less consequence.

Salt Water Meadows.

Grasslands of a relatively small extent, but important in some areas, are pastures near the sea composed of salt-loving grasses. In some places the salt meadow consists of almost a pure stand of Saltwater Couch (*Sporobolus virginicus* var. *minor*). In other areas the Maritime Rush *(Juncus maritimus* var. *australiensis)* may form almost a pure stand of several acres in extent though it is generally associated, particularly on the edge of the swamps, with various sedges and allied plants. Succulents are typical of the salt-meadow, the commonest being Glasswort *(Salicornia),* Sea Blite *(Suaeda),* a Salt Bush (*Enchylaena*) and a creeping plant, *Sesuvium portulacastrum.*

Woodland Areas or Forests.

The Woodland areas or forests can be divided along broad lines into several distinct types:—(1) The Littoral or Coastal forests; (2) the Sub-Littoral forests; (3) the Open Eucalyptus forests; (4) the Vine Scrubs or Jungles (known to the botanist as rain forests); (5) the River forests; and (6) the Inland scrubs.

Littoral or Coastal Forests.

MANGROVE FORESTS.

The Littoral forests are of two main types. The forest below high-water mark (mangrove forests), and those above high-water mark (beach forests). The mangroves are extremely interesting trees, showing a wonderful adaptability to the conditions under which they grow. Their roots not only act as a means of anchoring the trees firmly in the muddy substratum in which they grow, but the parts above water also act as breathing organs. They are covered by breathing apertures known as lenticels, are of a spongy nature, and through the lenticels communication with the atmosphere is maintained. This is very essential, as the trees are growing in a very badly aerated soil, and unless communication between the subterranean roots and the atmosphere was established in some way the trees would become suffocated. The fruits are also peculiar from the fact that germination takes place while still on the tree, and the young plant is ready to anchor itself in the mud as soon as it drops from the parent tree; if this did not happen the seeds would become washed about from place to place and difficulty would be found in finding a footing.

Common mangroves of the Queensland coast are the Red Mangrove *(Rhizophora),* the Black Mangrove *(Bruguiera),* the small Mangrove *(Ceriops),* the White Mangrove *(Avicennia),* and the Milky Mangrove *(Excaecaria).* The first two are of some importance as tanning agents, but they have not found general favour amongst tanners in Australia owing to several disadvantages. These disadvantages can be overcome, but the expense of doing so does not compensate tanners for the trouble involved.

The White Mangrove is one of the few species of mangroves that extends outside the tropics, being common all round the Australian coasts, and extending to New Zealand. The bark of this tree has no

value for tanning purposes, but the leaves are of use as a fodder, and in times of drought in coastal areas the White Mangrove has saved many head of stock.

The Milky Mangrove is poisonous and possesses a milky sap with strong blistering properties. If it gets into the eye it causes intense pain and temporary blindness.

An interesting member of the mangrove flora in some parts of North Queensland is the Nipa Palm *(Nipa fruticans)*. The Nipa Palm is at present confined to a few parts of North Queensland, the Pacific Islands, and tropical Asia, but at one time evidently had a wide range over the regions of the world, as nuts in a good state of preservation are commonly found in the Tertiary deposits at the mouth of the Thames in England. Where it grows the leaves of the Nipa Palm are preferred above all others as thatch for native houses.

Beach Forests.

The Littoral forests above high-water mark are of two types—those of the dry land, and those of the swamps. Those of the former are again divided into two types—(1) Those of the ocean foreshores, and (2) those of the bay foreshores. The two outstanding trees of the ocean foreshores or sand dunes of Eastern Queensland are the Coast Oak *(Casuarina equisetifolia)* and one or two species of Pandanus. The latter show great adaptability to their environment, for they are provided with prop roots, which anchor the trees very firmly in the loose sandy soil in which they grow. These prop roots are essential, as the large leaves and the large heavy heads of nuts are borne at the extreme ends of the branches, and but for these roots the trees would very easily be blown over by the high winds which prevail on the coast.

Another tree often seen on the foreshores immediately behind the dunes is the Sand Cypress *(Callitris columellaris)*. When growing in such situations it is usually rather dwarfed, and the tops cut off in an oblique direction by the prevailing winds, giving the crown a sloping appearance.

Common trees on the bay foreshore often just above the mangrove formation are the Cotton tree (*Hibiscus tiliaceus*), and the Cupania (*Cupania* or *Cupaniopsis anacardioides*).

Trailing sand-binders are characteristic plants of all coastal sand dunes. Along the sand dunes in Queensland are found the universal *Ipomoea Pes-caprae* (the Goat's-foot Convolvulus), *Vigna lutea* with yellow and *Canavalia obtusifolia* with rather purplish-pink flowers respectively; *Acacia longifolia* var. *Sophorae,* common on the more southern beaches, has prostrate stems 10 or 12 feet long trailing over the sand. *Stephania hernandiæfolia* is common just behind the sand dunes, as is *Hibbertia volubilis;* these last two plants seem to be equally at home on the sandy beaches as in the rich tropical and sub-tropical rain forests, two habitats the opposite of one another as far as conditions for plant life are concerned. Sand-binding grasses are represented by *Spinifex hirsutus, Zoysia pungens* (Coast Couch), *Ischæmum triticeum, Lepturus repens, Thuarea sarmentosa,* and *Stenotaphrum subulatum.*

Succulent plants are characteristic of coastal floras. Along the sand dunes in Queensland succulent plants are represented by *Mesembryanthemum aequilaterale* (Pig Face), *Tetragonia expansa* (New

Plate 50.

Noosa Beach from top of Paradise Caves, showing Pandanus (*Pandanus pedunculatus*) and She-Oak (or Sheoke) trees (*Casuarina equisetifolia*).

[Photo., Queensland Government Tourist Bureau.

Zealand Spinach), *Cakile maritima, Scaevola suaveolens,* and the two spurges *Euphorbia atoto* and *E. eremophila. Oxalis corniculata* (Wood Sorrel) and *Sonchus maritimus* of a less succulent nature are also common on many beaches. *Sesuvium portulacastrum,* sometimes found on the dunes, is more abundant on the saltpans.

SUB-LITTORAL FORESTS.*

I have applied the term sub-littoral forests to two types of woodland—(1) Coastal swamps or tea-tree swamps, and (2) the country known universally in Queensland as "wallum"; these are essentially coastal types, though they may continue inland for about 10 miles, or in more isolated patches for even more.

COASTAL FRESHWATER SWAMPS.

Lying close in from the beach in much of coastal Queensland are very large freshwater swamps. The outstanding tree of these swamps is the common Paperbarked or Broad-leaved Tea-tree *(Melaleuca viridiflora* and its allies). Where this tree grows the ground is often covered with a thick growth of the Bungwall Fern (*Blechnum serrulatum*), and its rhizomes sometimes climb up the trees through the outer layers of the papery bark for quite a considerable distance. Another fern often so common as to be an outstanding feature of the vegetation is the so-called Climbing Maidenhair (*Lygodium scandens*). In some parts the Tea-tree is displaced by the Swamp Oak *(Casuarina glauca)*. Other trees present in these coastal swamps are *Eucalyptus robusta* (sometimes called Swamp Mahogany), *Tristania suaveolens* (the Swamp Mahogany), and to a lesser extent Eucalyptus umbellata (*Synonym Eucalyptus tereticornis)*, the Queensland Blue Gum.

The trees of these coastal swamps have to withstand conditions very unfavourable to plant growth—*i.e.*, periods of inundation alternating with those of comparative drought—so that they are mostly xerophytic in habit, with tough, leathery, commonly vertically placed leaves, and some, such as the Blue Gum, Swamp Mahogany (*Tristania*), and Tea-tree, can adapt themselves to ordinary dry forest conditions. *Melastoma malabathricum* is a common shrub of the coastal swamps. It is known to Queensland children as Blue-tongue, as the fruits when chewed stain the mouth bluish black all over.

In the wetter parts where the water is more permanent aquatic plants as the Water Lilies (*Nymphæa* spp.), of which the commonest is the Blue Water Lily (*N. gigantea*), Swamp Lily (*Ottelia*), the Fringed Water Lily (*Limnanthemum*), Bur-reed (*Sparganium angustifolium*), Bulrush (*Typha angustifolia*), and various sedges and allied plants are found growing.

Water grasses are represented by the Dutch Millet *(Paspalum orbiculare)*, the Water Couch *(Paspalum distichum)*, Wild Millet (*Echinochloa*), Rice Grass (*Leersia*), Common Reed (*Phragmites*), and others.

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* The Latin prefix "sub," meaning under or below, is very frequently employed in botany in compound words, and implies an approach to the condition indicated; *e.g.*, sub-littoral forests are forests close to the sea but not actually on the shore-line; sub-tropical forests are forests not actually growing in the tropics but approaching the tropics or tropical richness very closely; leaves sub-opposite means that the leaves are not quite but nearly opposite, and so on.

"WALLUM."

The term "Wallum" is applied in Queensland to barren country in the coastal belt covering large areas, particularly in the Moreton Bay, Wide Bay, and Hervey Bay districts. It consists largely of peat swamps, in some places very wet, alternating with sandy ridges covered with a fairly dense woodland consisting of low, stunted eucalypts, *Banksia*

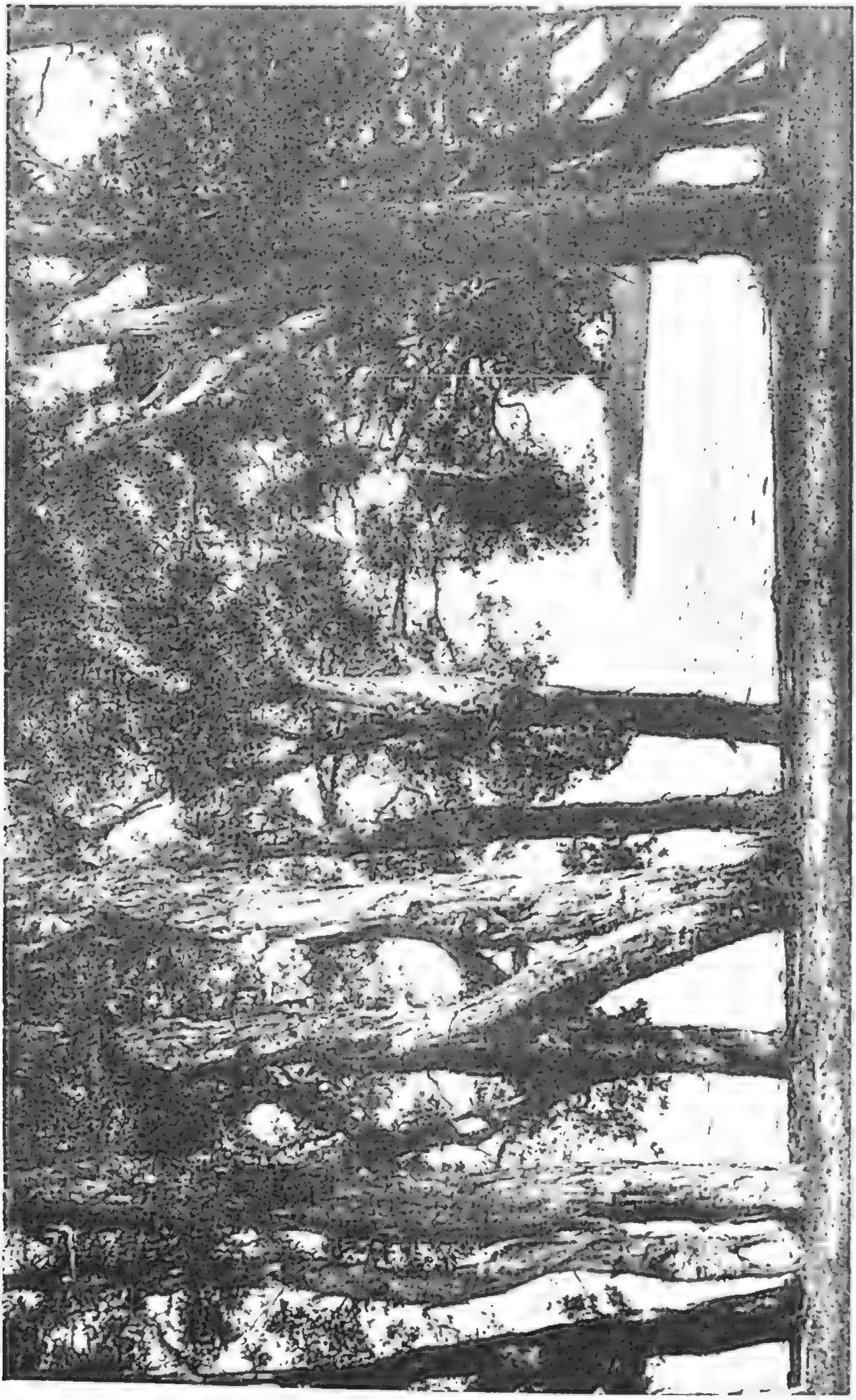

Plate 51.

LAKE COOTHARABA.—The trees in the foreground are Broad-leaved or Paper-barked Tea Trees (*Melaleuca viridiflora*). This species often forms pure stands of many acres in extent in freshwater swamps near the sea.

[*Photo., Queensland Government Tourist Bureau.*

aemula, &c. This latter is the characteristic tree of much of the sandy tracts and is itself known as "Wallum." In the peat swamps *Sphagnum* moss may occur, though it is not so characteristic of this formation as it is in colder countries, and other plants enter mostly into the formation of the peat. The peat swamps of South-eastern Queensland possess a great many flowering shrubs and undershrubs, and during the spring months are usually gay with wild flowers. These include more particularly many Leguminosae, Myrtaceae, Epacridaceae, and Proteaceae endemic in Australia. The Sedges and their allies are also usually well represented. Insectivorous plants, always more or less characteristic of peat swamps (" high moors ") in all parts of the world, are represented by several Sundews (*Drosera* spp.). Grass-trees (*Xanthorrhaea* spp.) are common in most of the " Wallum." Lycopods or Club Mosses to be found there are *Lycopodium cernuum* and *L. laterale*, and in some places the Coral Ferns (*Gleichenia circinnata* and *G. dicarpa*) are very abundant.

The sand hillocks in the " Wallum " contain a very rich mixture of Australian types—Epacridaceae or Australian Heaths, Leguminosae, Myrtaceae, Proteaceae, and Rutaceae predominating.

Open Eucalyptus Forests.

The open Eucalyptus forest (savannah forest), as in the other States of Australia, is the main forest type of Queensland. It varies a good deal in composition of species according to whether coastal or inland, northern or southern, whether occurring on rich deep soils or barren siliceous ones, &c.

Though the Eucalypts in themselves form a very natural group, they present many difficulties at any attempt to arrange the species into natural groups, each group possessing a number of characters in common. As far as the Queensland species are concerned, for the purpose of giving a brief account of the genus, the species can be most conveniently divided into five groups, according to their bark characters, viz.:—

(1) The smooth-barked trees or gums proper with a trunk normally smooth, the bark coming off in scales or strips leaving a clean, smooth barrel; bark commonly persistent at the base of the trunk and very rarely persistent for some time almost up the entire trunk. Characteristic trees of this group are *Eucalyptus saligna* (the Flooded Gum), *E. tessellaris* (the Moreton Bay Ash or Carbeen), *E. maculata* (the Spotted Gum), *E. micrantha* (the Scribbly Gum), *E. Seeana* (Narrow-leaved Grey Gum), *E. propinqua* (the Grey Gum), *E. Torelliana* (Cadagi), *E. platyphylla* (Poplar Gum), and *E. papuana* (Cabbage Gum).

(2) The Boxes with dark-grey, fibrous, much interlocked bark, often shed on the upper part of the trunk and main limbs in strips or patches. Characteristic trees of this group are *Eucalyptus albens* (White Box), *E. conica*, *E. hemiphloia* (Gum-topped Box), *E. melliodora* (Yellow Box), *E. populifolia* (Bimble Box), *E. pilligaensis* (Ribbon Box), *E. microtheca* (Coolibar), *E. quadrangulata*, *E. Cambageana* (Mountain Coolibar), and *E. leptophleba* (North Queensland Box).

(3) The Stringybark trees with a very fibrous bark, persistent on the trunk and branches. Typical trees of this group are *Eucalyptus resinifera* (Red Stringybark), *E. capitellata* (Brown Stringybark),

E. eugenioides (White Stringybark), *E. acmenioides** (Yellow Stringybark) and *E. Planchoniana*, &c. Less typical but placed in this group for the purpose of convenience are *E. Baileyana* (Rough Stringybark), *E. microcorys* (Tallow-wood), and *E. exserta* (Peppermint).

(4) The Ironbarks possess a hard-furrowed, black or dark-grey persistent bark, rather friable and the interstices often carrying a dark red kino ("gum"). Typical trees of this group are *Eucalyptus melanophloia* (Silver-leaved Ironbark), *E. paniculata* (Grey Ironbark), *E. crebra* (Narrow-leaved Ironbark), *E. siderophloia* (Broad-leaved Ironbark). The Mugga or Red Ironbark *(E. sideroxylon)* is common along parts of the New South Wales-Queensland border; the bark is often of a more friable nature than the other ironbarks.

(5) The Bloodwoods are trees with a persistent bark, commonly inclined to be spongy and friable and roughly and irregularly tessellated, the outer layers lamellar and the inner layers sub-fibrous. Typical trees of this group are *Eucalyptus corymbosa* (Red Bloodwood), *E. trachyphloia* (White Bloodwood), *E. terminalis* (Western Bloodwood), *E. dichromophloia* (Northern Bloodwood), and the various trees known in Queensland as Yellowjacket—*e.g., E. peltata, E. Bloxsomei, E. Watsoniana, E. similis,* &c.

The Marlocks and Mallees are not represented in Queensland, though a species of mallee-like growth, *E. Bakeri,* occurs in fairly considerable areas in some interior parts along the New South Wales-Queensland border, and in parts of the Burnett District and Central Queensland.

In parts of coastal North Queensland large areas are covered with Broad-leaved Tea Trees (mostly *Melaleuca Leucadendron* var. *Cunninghamii)* at times forming pure stands, but usually mixed with Eucalypts.

A genus allied to Eucalyptus and very much abundant in the open forest is *Angophora,* the best known members of which are the Rusty Gum *(A. lanceolata)* and the Apple-trees *(A. intermedia* and *A. subvelutina). A. melanoxylon* is very common about Charleville, Western Queensland; *A. Woodsiana,* common in South-east Queensland, is popularly known as Apple-tree Bloodwood.

Another genus allied to Eucalyptus is *Tristania* with two species, viz., the Swamp Mahogany *(Tristania suaveolens)* and the Scrub Box *(T. conferta)*, very common in forest country. The former, as its name implies, is commonly found in swampy country, but is certainly not confined to it, being found in the ordinary open forest; its timber is preferred above all others for piles and fender posts for wharves, being especially resistant to the attacks of the marine worm or teredo. The Scrub Box, as its name implies, is often found on "scrub" (rain-forest) edges. Its timber is very little cut in Queensland, due probably to its tendency to warp in small sizes.

The Turpentines *(Syncarpia laurifolia* and *S. Hillii)* are timbers that are in great demand for piles, also for fender posts for wharves. They are rarely cut in Queensland, due to their tendency, like the Scrub Box, to warp in small sizes, but are highly useful, very much underrated hardwoods.

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* *E. acmenioides* and the two allied species, *E. carnea* and *E. umbra,* known in Queensland as Yellow Stringybarks, are not regarded in New South Wales as typical of the Stringybark group, and are universally known as Mahoganies.

An interesting member of the open forest is the Sandalwood *(Santalum lanceolatum)*, parasitic on the roots of other trees. The Sandalwood is common throughout Western New South Wales and Queensland. The main port of export for Queensland is Thursday Island. It is not always found in the open forest, and in the more southern parts of the State grows mostly in the inland scrubs. A tree that commonly goes under the name of Sandalwood in Western New South Wales and Queensland is *Eremophila Mitchellii,* also known in the former State as Buddah. The wood is very strongly scented, but is of no value as a "sandalwood," and attempts to get it on the market have always failed. It belongs to a very different family from the true Sandalwoods. When the Sandalwoods were cut out from the Hawaiian Islands, attempts were made to substitute the wood of a tree allied to the Australian Buddah, and like it with a strong scent, but the Chinese buyers would have none of it. It is possible, however, that it will have some value for wood distillation, as the oil it contains should be valuable for use in the manufacture of scents and perfumes, possessing as it does a desirable, heavy, "oriental" odour. Another Santalaceous tree with a faint sandalwood odour is *Exocarpus latifolia* found in varying quantities along the whole coastal belt.

Other trees making up the open forest are various Wattles *(Acacia)*, *Albizzia* (commonly called Acacia), Honeysuckles (*Banksia*), She Oaks (*Casuarina*), Red Ash (*Alphitonia*), Geebungs (*Persoonia*), Cypress Pines *(Callitris)*, Native Cherry *(Exocarpus cupressiformis)*, Kurrajong *(Brachychiton)*, Swizzle *(Timonius Brownii)*, *Grevillea* spp., *Hakea* spp. (Needle Bushes), &c.

RAIN FORESTS.

The vine scrubs or jungles (rain-forests) reach their greatest development in Australia in coastal Queensland. They consist of heavily dark-foliaged trees, and an abundance of climbers; many of the trees produce huge plank buttresses at the base. Queensland genera in which plank buttresses reach their greatest development are *Ackama* (Pink Marara), *Cedrela* (Red Cedar), *Dysoxylon* (Red Bean and Spurwood), *Elaeocarpus* (White or Blue Quandong), *Eugenia* (Water Gum), *Ficus* (Figs), *Geissois* (Red Carrabin), *Sloanea* (Yellow Carrabin), and *Tarrietia* (Booyongs, Tulip Oaks or Stave Woods).

It is rather unfortunate that in Queensland the name "scrub" should have become attached to this rich type of jungle, as the term "scrub," not only in other parts of Australia but in other parts of the world, as well as in botanical terminology, refers to low, stunted vegetation, the direct opposite to that which occurs in the so-called vine scrubs of Queensland. Rain-forest, as the name implies, is dependent on a high rainfall for its luxuriant development, and in Queensland rain-forest of the more luxuriant type is not found in areas possessing a rainfall under 50 inches (1,275 mm.) per annum. Rain forests of an increasingly drier type, the trees smaller, undergrowth less, and of a more general xerophytic type, occur in areas with a rainfall down to 35 inches (about 900 mm.) per annum. Rain forest is a purely coastal type and does not occur more than 100 miles inland. Mostly it is a narrow fringing belt along the coast.

In the southern (extra-tropical) parts of the State many of the trees, including the rain-forest species, are common to New South Wales and Queensland, but in the tropical parts of the State most of

Plate 52.

Tropical rain-forest or jungle with large Banyan Tree (*Ficus* sp.) in foreground, Malanda, North Queensland. [*Photo., Queensland Government Tourist Bureau.*

the species are endemic or if not confined to Queensland spread to either Polynesia, Melanesia, or the Malaysian region, some of them spread over the whole of these areas or with an even wider distribution.

The number of actually Australian types found in the vine scrubs is small, the majority of plants belonging to families, a good few to genera, and a few to species that are cosmopolitan in the tropics and sub-tropics, Malaysian types predominating. Interesting Asiatic types occurring in Queensland are *Rhododendron* and *Garcinia* (the Mangosteens); the former reaches its southernmost limit of distribution in North Queensland, but the latter genus extends to New Caledonia.

An objection is sometimes made to calling many of our rain-forest or jungle plants Malayan types, but the reason for it is that many of the groups such as the Figs, Eugenias, Mangosteens, &c., are found in the Malayan region in far greater abundance than in Australia.

Even in the rain forests, though the Malaysian element may predominate as regards families and genera, the degree of endemism developed among the species is high enough to support the contention of Dr. E. D. Merrill, one of the foremost living authorities on the flora of the Malaysian region, that Australia and Asia have remained separate since the epi-Mesozoic interval or Eocene, a time when the flowering plants had already reached a dominant place in the vegetation of the world. A peculiar feature of the flora of the North Queensland rain forests is the development of a number of small (in some cases monotypic) genera. These are especially numerous among the Proteaceæ, or Silky Oaks, of North Queensland, *e.g., Austromuellera, Buckinghamia, Cardwellia, Carnarvonia, Darlingia, Hicksbeachia, Hollandæa, Musgravea* and *Placospermum*.

The Malaysian tropical element reaches its southern limit in coastal Queensland and New South Wales, and on the other hand, the so-called Antarctic element reaches its northern limit in Queensland rain forests. An interesting example of this latter is the so-called Antarctic Beech or Niggerhead *(Nothofagus Moorei)*, which is abundant on the Macpherson Range.

It is in the rain forest that the most important coniferous softwoods of the State occur, viz., the Hoop Pine *(Araucaria Cunninghamii)*, the Bunya Pine *(Araucaria Bidwillii)*, and the Kauri Pines *(Agathis)*; of the last, three species occur in Queensland, of which the one most commonly cut at the present time is *A. Palmerstonii*, of North Queensland. Fortunately the native coniferous timber trees do well under silvicultural conditions and make rapid growth. Podocarps (see p. 757) in the rain forest are represented by the She Pines or Brown Pines, *Podocarpus elata, P. amara*, and *P. disperma*; *P. Ladei* is a rarer species, so far as known confined to Mount Spurgeon, North Queensland.

The genus *Flindersia* (commemorating the name of Matthew Flinders, the famous navigator) is a genus of about twenty species, all except a few found in Australia, and all the Australian species are found in Queensland. It is an interesting exception as forming a large Australian group found in the rain forests. After *Eucalyptus* and *Araucaria, Flindersia* is probably the most important genus of Australian timber trees. It contains the Crow's Ash or Teak *(F. australis)*,

Plate 53.

Second-growth forest composed mostly of Sarsaparilla or Red Ash (*Alphitonia Petriei*), Atherton Tableland, North Queensland. The trees in the foreground with large pinnate leaves are *Polyscias Murrayi*, popularly known in North Queensland as Palm Tree. It is a very characteristic regrowth species. [*Photo.*, Queensland Government Tourist Bureau.

Yellowwood *(F. Oxleyana)*, Cudgerie *(F. Schottiana)*, Silkwood *(F. Pimenteliana)*, Maple *(F. Brayleyana)*, Cairns Hickory (*F. Ifflaiana*), and other timber trees.

Other cabinet woods of the Queensland rain forests are the various species of Silky Oaks (Proteaceæ), of which *Cardwellia sublimis* is the most abundant and at the present time the common species of the trade, Red Cedar (*Cedrela Toona* var. *australis*), White Cedar (*Melia dubia*), Red Bean (*Dysoxylum Muelleri*), Black Bean (*Castanospermum australe*), Acacia Cedar or Red Siris (*Albizzia Toona*), Yellow Siris (*Albizzia xanthoxylon*), Booyongs (*Tarrietia* spp.), Red Carrabin (*Geissois Benthamii*), Yellow Carrabin (*Sloanea Woolsii*), Calophyllum (*Calophyllum costatum*), the White Beeches (*Gmelina Leichhardtii* and *G. fasciculiflora*), Rose Walnut (*Cryptocarya erythroxylon*), Tulip Wood (*Harpullia pendula*), Queensland Walnut (*Endiandra Palmerstonii*), Burdekin Plum (*Pleiogynium Solandri*), Daintree Maple or Cairns Pencil Cedar (*Lucuma galactoxylon*), Yellow Hickory, (*Nauclea Gordoniana*), and a number of other timbers not cut to any extent.

On some parts of the Downs and a few other inland localities there is a type of " scrub " which, in addition to trees that also occur on the coast, contains several distinctive ones; the most outstanding is the Bottle-tree (*Brachychiton rupestre*). Trees such as the Lignum-vitæ (*Vitex lignum-vitæ*), Crow's Ash (*Flindersia australis*), *Booyong* (*Tarrietia argyrodendron*), &c., are usually much smaller than the same species in the coastal belt.

Rain-forest or Jungle Regrowth.

When the rain forest is felled and burned it is usually followed by a more or less dense secondary growth. These may consist of imported or native weeds such as Wild Tobacco (*Solanum auriculatum* and *S. verbascifolium*), Ink Weed (*Phytolacca*), Lantana (*Lantana camara*), Thistles, etc., or of trees such as Red Ash or Sarsaparilla (*Alphitonia*), Wattles (*Acacia*), Bleeding Heart (*Homalanthus*), &c.

RIVER FORESTS.

Along many of the Australian freshwater rivers, both inland and coastal, a number of trees occur that always follow the watercourses, being rarely found anywhere else, such as the River Red Gum (*Eucalyptus rostrata*), Red Bottle-Brush (*Callistemon viminalis*), River Tea-Tree (*Melaleuca bracteata*), Weeping Tea-Trees (*Melaleuca leucadendron* vars.) River Oak (*Casuarina Cunninghamiana*), Weeping Myrtle (*Eugenia Ventenatii*), Water Gum (*Tristania laurina*), Gutta-percha (*Excœcaria parviflora*), &c. Other trees such as the Bean-tree (*Castanospermum*), Blue Gum (*Eucalyptus tereticornis*), Lilly Pilly (*Eugenia Smithii*), Creek Cherry (*Eugenia paniculata*), &c., occur along the rivers, but are also found in the vine scrubs or open forests as the case may be.

In the mountain rain forests of the coast characteristic moisture-loving plants growing between boulders in the rocky watercourses are species of *Elatostemma* (Urticaceæ) and *Helmholtzia* (Philydraceæ).

In Western Queensland, as the watercourses dry up the beds may be clothed with a growth of annual herbs of which species of *Centipeda* (Sneezeweed), *Chenopodium* (Goosefoot), *Commelina* (Scurvy Grass), and *Mollugo* (Carpet Weed) are prominent members.

INLAND SCRUBS.

Many scrubs in the western and northern parts of the State are often formed by pure or almost pure stands of particular species of Wattles (*Acacia*), such as the Brigalow (*A. harpophylla*), Mulga (*A. aneura*), Boree (*A. homalophylla*), and Lancewood (*A. Shirleyi*) scrubs respectively. Another tree forming large inland scrubs and usually associated with the Brigalow is the Beelah (*Casuarina lepidophloia*).

Plate 54.

Mulga (*Acacia aneura*) scrub with an undergrowth of Turkey Bush (*Eremophila Goodwinii*), between Bollon and Cunnamulla, South-West Queensland.

[*Photo. by S. L. Everist.*

Associated with the various species of Wattles and Beelah are other trees such as the Wilga (*Geijera parviflora*), Emu Apple or Gruie (*Owenia acidula*), Mustard tree (*Apophyllum anomalum*), Supple Jack (*Ventilago*), Native Pomegranate or Bumbil tree (*Capparis Mitchellii* and other species), Whitewood (*Atalaya hemiglauca*), Western Rosewood (*Heterodendron oleæfolium*), Western Lime (*Eremocitrus*), &c. A remarkable feature about many of the Western trees is the high fodder value of their leaves, cattle being carried over long periods of drought on "scrub" feed.

[CONCLUDED.]

Chloris Grasses in Queensland

S. L. EVERIST, Assistant to Botanist.

PART III.*

THE RHODES GRASS GROUP.

THE four species dealt with in this part belong to what we may term "the Rhodes Grass group." They all bear a resemblance to the well-known Rhodes Grass, and are characterised by the presence of a large number of branches in the seed-head, vigorous leaf growth, and a tendency to spread by means of surface runners.

PURPLE TOP GRASS (*Chloris barbata*).

Botanical Name.—Barbata, from Latin *barbatus*—bearded, referring to the hairs on the spikelets.

Common Name.—The names Purple Top Grass and Purple Top Rhodes Grass have been applied to this grass. Purple Top Grass is shorter and aptly describes the plant.

Botanical Description.—Stoloniferous perennial; stolons flattened, stout and fairly long. Shoots flattened. Culms erect or geniculated at the base, flattened and striate, unbranched or sparingly branched from the lowermost nodes. Nodes and internodes glabrous. Leaves distichous, green. Leaf sheaths glabrous, striate, flattened and strongly keeled. Auricles small, with tufts of long white hairs. Ligule a small ciliolate rim. Collar small and inconspicuous, glabrous. Leaf blades up to 20 cm. long, folded and strongly keeled; 5 cm. broad at the base, tapering to a fine point; base of blade with a few scattered long hairs on the upper surface. Flowering culms erect. Spikes 5-20, usually 9-16, fasciculate, closely congested and not spreading, up to 8 cm. long, rather weak. Rhachis slender and scaberulous, tomentose at the base. Spikelets very numerous, closely imbricate, subsessile, in two rows on the lower side of the rhachis. Lower glume membranous, lanceolate, acute, 1-nerved, 1·5-1·7 mm. long. Upper glume membranous, elliptic or elliptic-lanceolate, acute or shortly mucronate, 1-nerved, 2·5 mm. long. Lower floret hermaphrodite; lemma firm in texture, obovate in outline, irregularly elliptic in profile, 3-nerved, lateral nerves close to the margins, margins in the upper part long, bearded; lemma 2-2·5 mm. long, folded and bluntly keeled, glabrous on the back except for a tuft of hairs near the middle close to the keel, apex with very short, acute points, awned from the sinus, awn slender, scaberulous, 4-5 mm. long; palea equal in length to the lemma, obovate or almost spathulate, 2-keeled, glabrous, thin in texture; lodicules 2, small, clavate, glabrous; stamens 3; stigmas 2, slender; ovary glabrous; caryopsis pale straw-coloured, shining, elliptic, obtusely triquetrous; embryo large, occupying half the caryopsis. Second floret consisting of an empty lemma only; lemma broadly cuneate in outline, narrowly cuneate in profile, 3-nerved, truncate at the apex, 1·2 mm. long, glabrous or sometimes hairy; awn

* Part I. of this series was published in May issue, 1935 (Vol. XLIII., page 474, "Queensland Agricultural Journal"), and Part II. in July issue, 1935 (Vol. XLIV., page 18, "Queensland Agricultural Journal").

slender, scaberulous, up to 5 mm. long. Third floret also an empty lemma only; lemma much inflated and almost globose, orbicular in outline, 3-nerved, truncate at the apex and upper edges inrolled, 1 mm. long; awn slender, scaberulous, about 3 mm. long.

Popular Description.—A rather robust grass with stout creeping stems, similar in general appearance to Rhodes Grass, but usually somewhat smaller. It is readily distinguished by its purple seed-head and by the smaller spikelets, which are also different in shape.

Distribution.—In Australia, *Chloris barbata* is almost confined to the tropics. Its chief occurrence in Queensland is along the coastal strip from Port Curtis northwards, though it has been found as far west as Julia Creek, on the Great Northern Railway. It also extends to Northern Australia. It is doubtful whether this grass is a native of Australia, as it is a widespread weed in the tropics of both hemispheres.

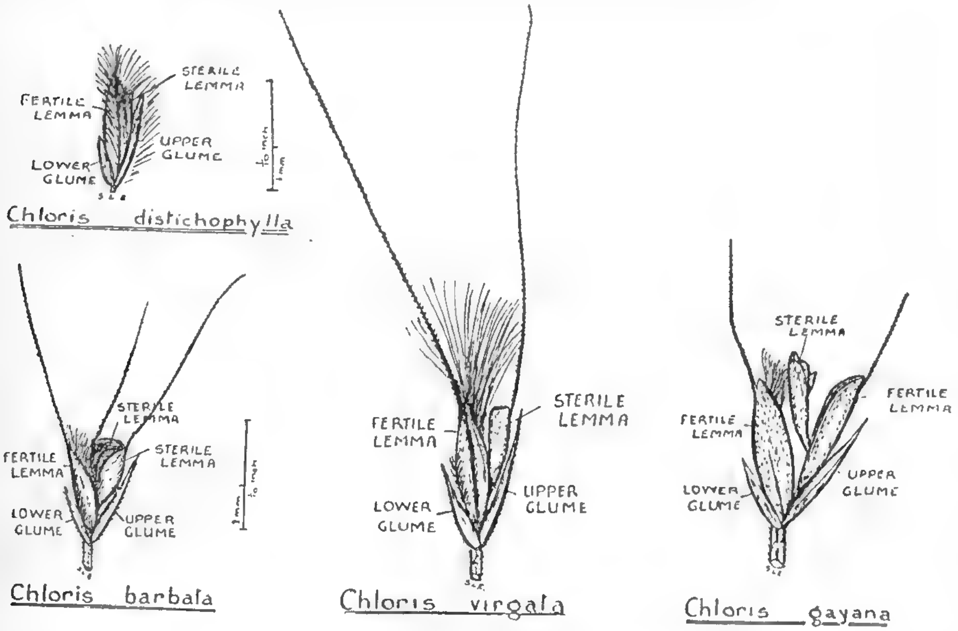


Plate 55.

Habitat.—In general, Purple Top Grass favours such situations as roadsides and old cultivation paddocks. It is seldom seen in undisturbed pasture lands.

Fodder Value, &c.—The general opinion concerning the fodder value of this grass seems to be that it is of little consequence. It looks inviting enough, but stock are apparently not at all fond of it. Possibly if the grass were kept short it would be eaten to a greater extent.

Reference.—*Chloris barbata* (Linn.), Sw. Fl. Ind. Occ. 1, 200 (1797).

FEATHER TOP GRASS (*Chloris virgata*).

Botanical Name.—*virgata*, from Latin *virgatus*—made of twigs. This probably refers to the much-branched stems, though it does not seem to be particularly applicable.

Common Name.—In Australia this grass has received a number of names. It was introduced by Col. Sylvester Browne, of Singleton, New

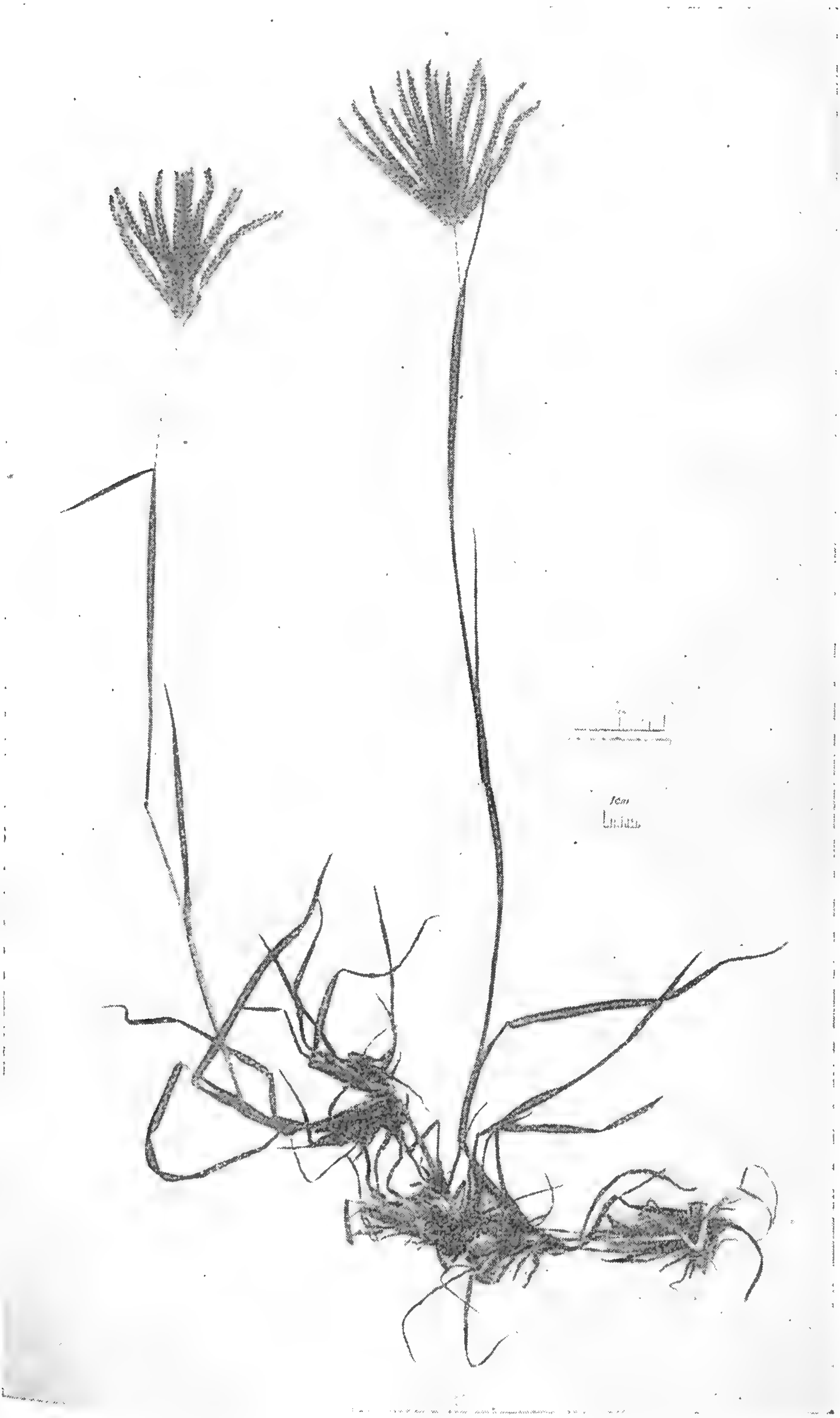


Plate 56.
Purple Top Grass (*Chloris barbata*).

South Wales, along with Rhodes Grass (*Chloris Gayana*), and for a while the two species were not distinguished and both were known as Rhodes Grass. In Queensland, of recent years, it has received the names Native Rhodes Grass, Feather Top Rhodes Grass, and Feathertop Grass. Of these, Feathertop Grass seems to be the best.

Botanical Description.—Annual. Culms decumbent and rooting at the nodes, eventually geniculate, and ascending sometimes up to 120 cm., sometimes less than 15 cm. Culms much-branched and producing leafy shoots at the branched nodes. Nodes and internodes glabrous, internodes exceeding the leaf sheaths, striate and somewhat flattened. Shoots flattened. Leaves distichous, green or straw-coloured when old. Leaf sheaths flattened, keeled tight in the lower part, looser and slipping away from the culm above, glabrous and striate or slightly hairy. Auricles usually with a tuft of long white hairs, which sometimes disappear as the grass grows older. Ligule reduced to a ciliolate rim. Collar narrow and inconspicuous, glabrous. Leaf blades folded in the bud, strongly keeled, even when mature, up to 50 cm. long, usually about 20 cm. when fully developed; the blades with a few long tubercle-based white hairs near the edge on the upper surface, about 5 cm. broad at the base, tapering to a fine point. Flowering culms erect or obliquely ascending, the uppermost leaf sheath enclosing the inflorescence until maturity, when the spikes are exserted. Spikes digitate, 6-14, usually about 12, closely clustered, not spreading, 3-9 cm. long. Rhachis slender, triquetrous, densely but shortly hairy at the base, scabrous or shortly ciliate for most of its length. Spikelets sessile or subsessile, closely imbricate in two rows on one side of the rhachis. Lower glume 1-nerved, membranous, lanceolate, acute, up to 2 mm. long. Upper glume 1-nerved, membranous, narrowly oblong or elliptic, folded and keeled, the keel scabrous and produced into a 0·6-1 mm. long awn or mucro from the bifid apex of the 2·5-3 mm. long glume. Lower floret hermaphrodite; lemma 3-nerved, firm in texture, usually pale-coloured, but occasionally almost black when ripe; broadly elliptic in outline, irregularly elliptic in profile, folded and bluntly keeled, and with a longitudinal groove in the middle of each face, 2·5-3 mm. long. Edges shortly ciliate in the lower half, long-bearded near the apex, apex 2-lobed and awned from the cleft, the lateral lobes short, acute; awn scabrous, long, slender, and straight, about 2 cm. long; palea membranous, 2-keeled, almost as long as the lemma, obovate or almost elliptic; lodicules 2, small, cuneate; stamens 3; ovary glabrous; stigmas 2; caryopsis terete or slightly flattened, narrowly elliptic, up to 2 mm. long, surface brown, smooth, and shining.

Popular Description.—An annual grass, the stems of which spread out along the ground and root at the joints before growing upright. It sometimes grows up to 4 feet high, and occasionally flowers when less than 6 inches high. The leaves are long, green, and folded; the shoots are flattened. The seed-head consists of numerous fluffy white spikes at the top of a short stalk. When young, the spikes are enclosed within the uppermost leaf. The "seeds" or spikelets are pale in colour, and bear tufts of long hairs and two long, slender awns.

Distribution.—*Chloris virgata* is a common tropical and subtropical weed widely spread over both hemispheres. In Queensland it is widely distributed, and has been recorded from all districts except the far south-west and centre. It is particularly abundant on the coastal and downs country.

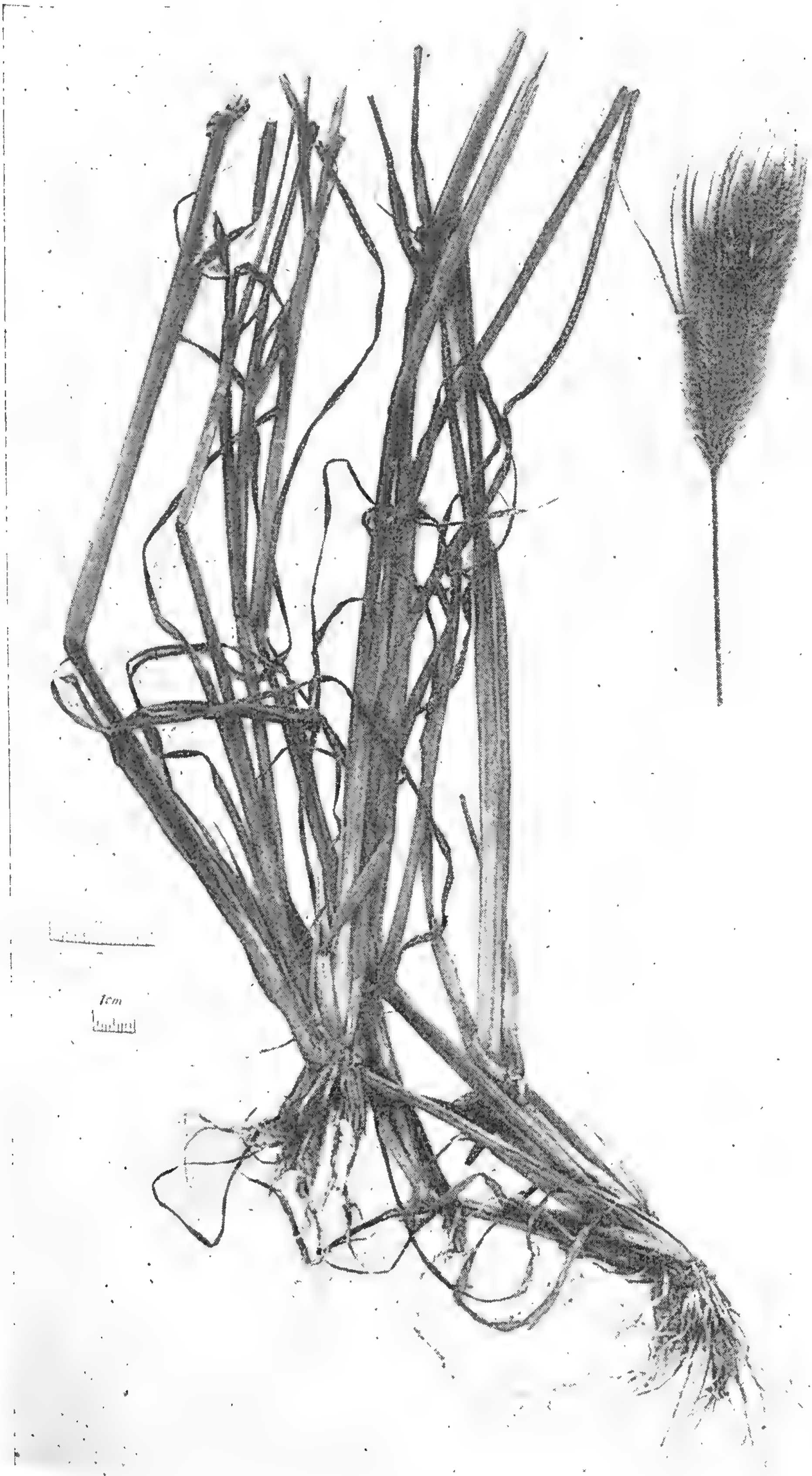


Plate 57.
Feather Top Grass (*Chloris virgata*).

Habitat.—*Chloris virgata* is a common weed of cultivations, particularly lucerne paddocks, and it is frequently found along roadsides.

Fodder Value, &c.—Conflicting reports have been received at various times concerning the fodder value of Feathertop Grass. Most of them indicate that although the grass looks tempting enough, stock will not eat it when other feed is available. Others state that it is liked by stock in all stages of growth, and others again that stock will eat it when made into hay. The general consensus of opinion seems to be that its presence is undesirable, since better grasses will usually thrive in the same situations.

Reference.—*Chloris virgata,* Sw. Fl. Ind. Occ. 1, 203 (1797).

RHODES GRASS (*Chloris Gayana*).

Botanical Name.—*Gayana,* apparently named after a Mr. Gay. I can find no record of the exact person to whom it refers.

Common Name.—In Australia this grass is known everywhere as Rhodes Grass.

Botanical Description.—Annual or perennial; in Australia usually a perennial up to 120 cm. high. Culms procumbent, branched, often rooting at the lower nodes and emitting fascicles of leaves. Leaves green, distichous. Leaf sheaths glabrous, striate, flattened and keeled, lower ones about as long as the internodes, upper ones comparatively shorter. Auricles small and inconspicuous, long-bearded or becoming glabrous with age. Ligule small, membranous, the edges ciliolate. Collar glabrous. Base of leaf blade immediately above the ligule densely covered with long, tubercle-based, white hairs. Leaf blade long, folded or flattened, acutely keeled, 3-5 mm. broad at the base, tapering to a fine point; glabrous except for the upper surface near the base and occasional long hairs along the edges, edges scabrous. Flowering culms erect, short. Spikes digitate, 7-17, usually 12-15 in number, obliquely erect when young, ultimately more or less horizontally spreading or sometimes slightly reflexed. Rhachis of each spike slender, shortly but densely tomentose at the base, scabrous or shortly ciliate for most of its length. Spikelets sessile, very numerous and closely imbricate in two even rows on one side of each rhachis. Spikelets with two hermaphrodite florets and one or two male florets above them, though sometimes there is merely an empty lemma above them. Rhachilla prolonged and frequently bearing a very much reduced empty lemma. Lower glume elliptic or ovate-elliptic, obtuse or shortly acute, 1-nerved and strongly keeled, up to 2 mm. long. Keel scabrous or shortly ciliate. Upper glume 3-3·5 mm. long, elliptic in outline, rather thin in texture, pale-brown in colour except for the thin transparent membranous margins, the edges of the brown portion with a fringe of long hairs in the lower part; glume 1-nerved and strongly keeled, the middle nerve prolonged into a short mucro, keel scabrous; apex of the glume acute or bifid. Lowest floret hermaphrodite, lemma 3·2-3·5 mm. long, firm in texture, broadly elliptic in outline, irregularly rhomboidal in profile, glabrous, folded and bluntly keeled, with a longitudinal groove in the middle of each face; 3-nerved, lateral nerves very close to the margins; margins ciliate in the lower half, long-bearded toward the apex; apex bifid with a short awn from the sinus; awn up to 7 mm. long, base of the

Plate 58.
Rhodes Grass (*Chloris Gayana*).

lemma with a ring of long hairs; palea as long as the lemma, thin in texture, 2-keeled, elliptic; lodicules 2, minute; stamens 3; ovary glabrous; styles 3, short; stigma laterally exserted; caryopsis about 1 mm. long, irregularly ovoid in shape, pale-brown in colour, dull or slightly shining; embryo almost as long as the caryopsis.

Second floret usually hermaphrodite. Sometimes, particularly when there are two male florets above it, it is identical with the lowest floret except for its slightly smaller size and the glabrous margins of the lemma. Usually the lemma is about 2 mm. long, obovate-cuneate in outline, narrowly oblong cuneate in profile, folded and bluntly keeled, 3-nerved, the lateral nerves close to the margins; apex shortly 2-lobed, with a short awn from the sinus. Palea as long as the lemma, spathulate, 2-keeled, glabrous. Lodicules, andræcium, and gynæcium similar to those of the lower floret, but smaller in size.

Third floret usually male, sometimes reduced to a broadly cuneate empty lemma. If male, it resembles the second lemma, but without a gynæcium.

Fourth floret, if present, sometimes male, but usually consisting of a small, broadly cuneate lemma. If male, it is similar in shape and structure to the third floret, but much smaller.

Popular Description.—Vigorous grass with running stems rooting at the joints and sending up leafy shoots. Leaves bright-green in colour, long and slender and tapering to a fine point. Usually free from hair except for a number of white hairs at the base on the upper surface. Seed-heads consisting of an erect stalk surmounted at the top by about 12-15 spreading branches. When young, these branches are erect; as they grow older they spread out and sometimes droop. Each branch bears upon the lower surface two rows of brown spikelets or "seeds" bearing 2 or 3 bristles.

Distribution.—Rhodes Grass was introduced into Australia from Africa by Col. Sylvester Browne, who first grew it at Singleton, New South Wales. In Queensland it is now extensively planted upon hillsides and in sub-coastal country where Paspalum will not thrive. In many places it has run out and become naturalised. It has been grown as far west as Winton.

Habitat.—Rhodes Grass grows best on alluvial or loamy soils, but will also thrive on lighter soils such as are encountered on the coastal ridges. When naturalised, it usually grows in such places as roadsides, railway embankments, and cultivation headlands.

Fodder Value, &c.—There is no doubt that Rhodes Grass is a valuable pasture grass, particularly in places such as coastal ridges and the sub-coastal dairying districts. It is useful also in rotational grazing with Paspalum pastures, and allows of the utilisation of ridgy country upon which ordinary Paspalum will not thrive. Rhodes Grass is particularly suitable for sowing after scrub "burns," since, if properly sown, it covers quickly and tends to keep weed growth in check. Particulars of methods of sowing and grazing are given in a pamphlet issued by the Department of Agriculture and Stock.

Reference.—Chloris Gayana Kunth., Rev. Gram. i. 89, ii. 293, t. 58 (1829).

Plate 59.
Evergreen Chloris (*Chloris distichophylla*).

EVERGREEN CHLORIS (*Chloris distichophylla*):

Botanical Name.—*distichophylla,* from Greek *distichos* (of two rows), and *phyllon* (a leaf), referring to the leaves being arranged in two opposite rows.

Common Name.—Several common names have been proposed for this grass, including Evergreen Chloris, Frost-resistant Rhodes Grass, and Winter-growing Rhodes Grass. It seems desirable to restrict the name Rhodes Grass to *Chloris Gayana* (see above). Evergreen Chloris is quite appropriate.

Botanical Description.—Tufted perennial; rhizomes short and stout, much-branched and producing numerous shoots from the upper side; majority of the shoots produced upon the outside of the clumps, a few within the clumps. Young shoots flattened. Leaves conspicuously distichous; leaf sheaths glabrous, scaberulous, striate, broad, rigid, flattened and sharply keeled, purplish at the base, green in the upper part, 5-20 cm. long; ligule reduced to a short membranous ring with minutely ciliate margin; leaf blades up to 50 cm. long, 7 mm. broad in the middle, tapering slightly towards the base, apex rounded, obtuse, margins scaberulous; blade with a prominent midrib, usually folded throughout its length, becoming flattened when old. Flowering culms erect, few-noded, up to 1 m. high, branches numerous, up to 45 in number and about 15 cm. long, slender, weak, semi-erect when young, drooping when mature; rhachis of the spikes slender, triquetrous, scaberulous above, shortly ciliate on the lower side. Spikelets small, numerous, closely imbricate in two rows on the lower side of the rhachis, 2-flowered. Glumes thin, membranous, pale straw-coloured; lower glume 1-nerved, 1·5 mm. long; lanceolate, acute; upper glume 1-nerved, up to 2·2 mm. long; elliptic-lanceolate, mucronate or shortly aristulate, point always shorter than 0·5 mm., lateral margins inrolled. Lower floret hermaphrodite; lemma usually dark-brown at maturity and thinly cartilaginous in texture, 2·5 mm. long, ovate-elliptic in outline, not or scarcely laterally compressed, rounded dorsally and with a shallow groove on each side, 3-nerved, the lateral nerves marginal, the middle nerve produced into a short blunt point; margins beset with a close fringe of long white hairs; palea almost as long as the lemma, somewhat thinner in texture, but of the same colour, 2-nerved, sharply 2-keeled, keels minutely ciliate; inrolled edges thinly hyaline in texture; lodicules flat, broadly cuneate, 0·1-0·2 mm. long; stamens 3, filaments slender, anthers broadly linear, slightly shorter than the filaments; stigmas 2, plumose; caryopsis dark-brown when ripe, slightly shining, ovoid in outline, plano-convex or almost triquetrous in cross-section, 1 mm. long, 0·5 mm. broad; embryo about half as long as the caryopsis. Sterile floret reduced to a lemma, thinly cartilaginous in texture, not compressed, not keeled, rounded on the back, somewhat inrolled at the tip, up to 1·5 mm. long, very broadly cuneate in outline, narrowly cuneate or semi-elliptical in profile, 3-nerved, the lateral nerves near the margins better developed than the middle nerve, which vanishes before reaching the apex; lemma awnless, apex inrolled, obtuse.

Popular Description.—Grass forming dense, leafy tufts sending up long seed stalks with numerous radiating branches at the top. Young shoots very flat, purplish at the base; leaves long, stiff, and usually

folded throughout their length. Seed stalks bearing numerous brown "seeds" or spikelets, each with a fringe of long white hairs.

Distribution.—Evergreen Chloris is a native of South America. It has been naturalised in Queensland for a very long time, but has never shown any tendency to spread. In Queensland it is naturalised chiefly in the Moreton and Wide Bay districts, though it is now cultivated in many parts of the State.

Habitat.—The grass, when naturalised, is usually found in waste places, on roadsides and embankments and other places where the ground has been disturbed. It is usually cultivated on soils similar to those suitable for Rhodes Grass.

Fodder Value, &c.—Until recently, little notice was taken of this grass from a grazing point of view. Of late years considerable attention has been paid to it because of its frost-resistant qualities. The grass is said to be palatable to stock and quite nutritious. However, tests made by the Agricultural Chemist indicate that Evergreen Chloris contains a prussic-acid-yielding glucoside. Because of this it would be wise to exercise care in feeding the grass to stock. Apart from its economic importance as a fodder, the grass is of value for ornamental purposes.

Reference.—*Chloris distichophylla,* Lagasca Gen. et Spec. Nov. 4 (1816).

[TO BE CONTINUED.]

TABLE OF UTERO-GESTATION.

Animal.	Average Period.	Early Period for Young to Live.	Late Period.
Mares	335-345 days (11-11⅓ months)	307 days (10 months)	365 days (12 months)
Cows	275-287 days (39-41 weeks)	242 days (34½ weeks)	312 days (44½ weeks)
Sheep and Goats	149-151 days (21-21½ weeks)	140 days (20 weeks)	160 days (23 weeks)
Sows	112-119 days (16-17 weeks)	105 days (15 weeks)	126 days (18 weeks)
Bitches..	63 days (9 weeks)	55 days (8 weeks)	70 days (10 weeks)
Cats	55 days (8 weeks)	50 days	64 days
Rabbits	28-30 days (4 weeks)	..	..

The Estimated Age of Some Queensland Trees.

W. D. FRANCIS, Assistant Government Botanist.

Introductory Remarks.

IN parts of the Northern Hemisphere, such as Europe and North America, it is well known that many kinds of trees produce annual rings in their wood. These annual rings are so well marked that the age of many trees can be accurately computed from them. Annual rings are especially well developed in Pine trees and their allies. A very large amount of work has been done on the Big Trees (*Sequoia gigantea*) of North America. These trees have special features which facilitate investigation. They are very large trees, and their wood rings are conspicuous when the stems are sawn or cut across. The writer saw a section of one of these very large trees which is exhibited in the Natural History Section of the British Museum in London.

The American investigators have calculated the ages of some of the specimens of the Big Tree and found that in some cases the trees were living 1,000 years B.C. In addition, some of the American investigators have used the growth rings of these trees as indicators of the climate of the past. These fascinating studies of the gigantic American trees have led some Queensland residents to hope that some of our trees may provide data of the climate of the past.

Queensland Studies.

About nine years ago the writer undertook a preliminary study of the growth rings in some native coniferous trees of this State. The purpose of the study was chiefly anatomical. It was also considered desirable to find out if our coniferous trees formed annual rings. A brief account of this work will be given in this article. In addition some observations made since will be outlined.

Cross sections of stems of the Hoop Pine (*Araucaria Cunninghamii*), Bunya Pine (*Araucaria Bidwillii*), and Queensland Kauri Pine (*Agathis robusta*) were prepared and examined. Fine microtome sections of the wood of these trees were also prepared and photographed under the microscope. It was found that there are growth rings in the trees examined. But it was soon realised that the growth rings are not so well marked and are not nearly so regular as those of European and North American trees. This result is not surprising in view of the character of our climate in comparison with the climate of Europe and North America. The regular yearly occurrence of low temperatures in which plant growth is suspended is characteristic of the North European and North American environment. These conditions obviously do not occur in Queensland—at least in the areas where the trees which were investigated by the writer grow.

Microscopic Features of Growth Rings.

Apart from their less regular and distinctive character, the growth rings of the trees investigated do not differ microscopically from those of Europe and North America. The principal features of growth rings

in the microscopic view are the size of the internal cavity of the wood cells and the thickness of the walls of the cells. In the outer or dark-brown portion of the growth ring, which is formed in the autumn or late summer, the internal cavity of the wood cells is smaller and the walls of the wood cells are thicker than those of the cells in the part of the ring formed in the spring or early summer.

In studying wood rings it is essential to distinguish between rings constituted as just described and the fine zones of soft tissue (or wood parenchyma) which are found in the wood of many trees, such as the Rosewood (*Dysoxylum Fraseranum*), Red Bean (*Dysoxylum Muelleri*), and Moreton Bay Fig (*Ficus macrophylla*). These are native trees.

Annual Rings in Queensland Trees.

The growth of rings of the Hoop Pine, Bunya Pine, and Queensland Kauri Pine consist of two portions which are distinguishable to the eye by their colours. The lighter-coloured portion corresponds to the spring or early summer wood. The darker portion, mostly dark-brown in colour, corresponds to the autumn or late summer wood. The writer observed that the boundaries of the growth rings are more sharply defined in mature or old trees than in young, quickly growing trees.

It was definitely established that two or perhaps more rings are sometimes formed in one year in the Queensland trees examined. On the other hand, there were fairly definite indications that in the Hoop Pine there were varying numbers of rings, each of which was produced in a single year. These could be called annual rings. They are characterised by their comparative uniformity and their occurrence in connected series of two or more rings.

Method of Estimating the Age of Queensland Trees.

The writer suggested that these comparatively uniform rings, which are apparently annual, could be used to estimate the age of a tree in which they occur. These apparently annual rings can be measured throughout the section of the stem and the average width of them calculated. The measured radius (or half-diameter of the stem) when divided by the average width of the apparent annual rings gives an estimated age for the tree.

Results of Estimating Age of Queensland Trees.

Using this method, the writer estimated the age of a Hoop Pine tree which was growing in the Gympie district. This tree was 117 feet (35 m.) in total height, and had a stem diameter of 21 inches (53 cm.). Its age was estimated at 135 years. The age of a Kauri Pine tree which grew in the Kin Kin district was estimated in the same way. This tree measured 120 feet (36 m.) in total height, and had a stem diameter of 54 inches (135 cm.). Its age was estimated to be 228 years. In this case, however, only the outer part of the section of the stem was available, and consequently the data for estimation were meagre. Some of the larger Kauri Pines which grew in the same district attained a height of 160 feet (48 m.), and a stem diameter of 8 feet (240 cm.). If these larger trees grew at the same rate as the one from which the partial section was taken, their age could be estimated at about 400 years.

Applying the same method, the age of a large Eucalypt, which is lying on the ground at Eagle Heights, Tambourine Mountain, was estimated. This tree presumably was a Flooded Gum (*Eucalyptus saligna*). It was apparently well over 120 feet (36 m.) in height and about 6 feet (180 cm.) in stem diameter. The age of this tree was estimated as between 150 and 200 years. Large Flooded Gum trees are a feature of the landscape of Tambourine Mountain. These trees have large, smooth, pale, column-like stems. At first sight the age of 150-200 years seems slight in comparison with their size and impressiveness. But the writer is convinced from observations of the growth of young trees of the species that this Eucalypt is an extremely fast grower.

The Reputed Age of other Queensland Trees and Plants.

Botanists are frequently asked about the age of the Antarctic Beech (*Nothofagus Moorei*). This species is confined to the mountain ranges of extreme South-eastern Queensland and the highlands of Northern New South Wales. The writer has no knowledge of any investigations which indicate even approximately the age of these trees. In many cases it would be difficult to form any idea of the age of these trees. The stems frequently branch out from a common base. The older stems die out. This produces a complicated position which is not met with in the usual case. Trees usually produce only one stem, and this persists from the beginning of the life of the tree.

The recent destruction of the large Cycad (*Macrozamia Denisonii*) on Tambourine Mountain has aroused interest in the age of these plants. It has been stated that the large specimen which was cut down was estimated to be 15,000 years old. The authority for this estimate is not known to the writer. Judging from Professor C. J. Chamberlain's statement in his book, "The Living Cycads," the procedure for estimating the age of a Cycad is scarcely so trustworthy as the annual ring method applicable to some trees. In the case of Cycads, observations extending over a period of years are necessary. In this periodic observation the number of leaves formed in a single year is ascertained. Next the leaf bases on the trunk of the Cycad are counted. The number of the leaf bases is then divided by the average number of leaves formed in a year. The result of this division gives the estimated age of the Cycad. Up to the present the writer is not aware if this procedure has been carried through on Tambourine Mountain.

Conclusion.

It is regretted that the investigations, so far as they have been prosecuted, do not provide any substantial basis for interpreting the climate of the past. It is realised that meteorologists and those who are concerned with the development of weather-forecasting would be materially assisted if native trees formed more regular rings. It is as well to remark, however, that the subject is still open for further investigation.

Photographs and photomicrographs of some of the sections of stems investigated in the earlier work are given in the places cited in the references below.

REFERENCES.

Francis, W. D.: The Growth Rings in the Wood of Australian Araucarian Conifers. Proc. Linn. Soc. N.S.W., Vol. 53, p. 71, 1928.

Francis, W. D.: Australian Rain-forest Trees. Pages 52-54, 1929.

Scattered storm rains have fallen over a wide area of the State, but up to the time of writing no soaking general rains have been received, and owing to the dry subsoil, the rains registered can only be regarded as giving temporary relief. Conditions are somewhat more favourable in the North-West, Atherton Tableland, Calen, Granite Belt, and South-West tobacco lands, but the main agricultural areas from Bundaberg to the Border are still in need of seasonal rains. The recent heat wave has also affected the position adversely, rapidly drying out the young green pastures and summer crops that had become established after the early January rains. Fortunately, water supplies in creeks, tanks, and dams have to some extent been replenished.

Fodder Crops.

A large area has been sown with various summer crops in an endeavour to provide for immediate requirements, and to supplement reserves depleted during the prolonged dry spell. Where conditions are suitable, the provision of early winter feed should now be receiving attention. The more popular varieties of sweet sorghum, such as saccaline, imphee, and white African are quite suitable for this purpose, particularly in the coastal areas where heavy frosts are not experienced. February sowings will provide a large bulk of palatable and nutritious fodder, which may be cut as required or utilised as silage. Unlike maize, which dries out rapidly after reaching maturity, the sorghums retain their succulence for a considerable time, even after light frosts have checked growth. Drilling the seed in rows approximately 3 feet apart is recommended in preference to broadcasting.

Millets, such as Japanese, white panicum, giant setaria (or giant panicum), and dwarf setaria (Hungarian or liberty millet), may also be sown during the present month, and are recommended where an early maturing crop is desired.

Potatoes.

The autumn crop usually planted during February produces heavier yields than the early or spring crop, and provides the bulk of the State's expanding production of this commodity. Owing to the partial failure of the early crop many growers will be obliged to purchase seed potatoes

at the prevailing high rates, a factor which may reduce the area ultimately planted. The use of sound seed and the rotation of crops are important factors in the control of Irish Blight, but the principal control is effected by the maintenance of a protective covering of Bordeaux spray solution. Seed treatment with the formalin solution is also advised, full particulars of which are obtainable on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Tobacco.

Weather conditions in the State during the past six months have been very unfavourable for the tobacco crop, and in many districts the period under review was one of the driest on record. Good rains during December and early January relieved the position, proving most favourable to the growth of the early crops, and to the fertilization and planting of the late crops. Present indications are that the area planted will represent an increase over that for the past season.

It is estimated that of Queensland's 1935-36 tobacco crop (approximating 2,000,000 lb.) at least 90 per cent. was sold at auction sales, and growers generally have expressed satisfaction with the values received. The new import duties imposed by the Commonwealth Government have had the effect of causing additional buyers to operate, thus creating greater opposition and brisker bidding.

Sugar.

Highly favourable growing conditions prevailed in all cane areas from Mackay north, during the month of January.

The Southern districts have received further scattered rains, and although the crop is making slow progress, it is decidedly backward; soaking rains are urgently needed to stimulate vigorous growth.

Cotton.

The cotton crops have made fairly satisfactory progress during the month. Late December rains were sufficient to promote good growth of plants in the earlier sowings and provide a nice start for subsequent plantings. Dry weather ruling through most of January steadied all growth, however, which has resulted in nicely developed crop prospects in most districts. Good rains are now required to assist the plants in further crop production.

The plantings as a whole have been free from serious insect attack. If favourable conditions occur from now on it is possible that any delay in planting will be largely overcome, with a resultant satisfactory crop production.

USES OF SODIUM SILICATE ON THE FARM.

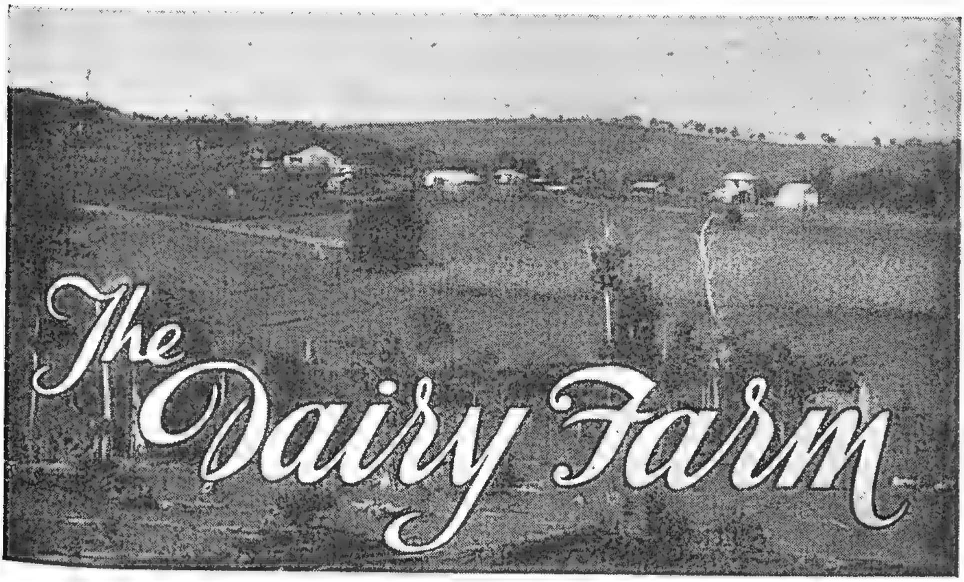
Sodium silicate, under the name of waterglass, is well known on farms as an egg preserver. In its different forms it has a variety of uses.

A hot one per cent. solution (1 lb. to 10 gallons) of alkaline sodium silicate is a powerful detergent, and is consequently used widely in cleansing floors, utensils, cream cans, bottles, &c. It is also used to remove grease and dirt from clothes.

Colloidal sodium silicate is used in proofing casks and rendering concrete floors, feeding troughs, holding tanks, &c., resistant to the acids that arise from bacterial action on fats, molasses and other fermentable substances.

Timber and fabrics may be impregnated with sodium silicate to render them fire proof. The solution is capable of acting as a vehicle for pigments and fillers so that two jobs may be done at once.

The Department of Agriculture and Stock will arrange for any enquiries on this subject to receive prompt attention.—Dr. M. WHITE.



ECONOMY IN DAIRY PRODUCTION.

G. H. E. HEERS, Director of Dairying.

A MEASURE of economy which involves the dairy farmer in very little extra work is to increase production by systematic herd testing and culling, and breeding only from the best producers.

Far too many herds include cows whose production falls far below average, and the dairy would be run far more economically if these cows were fattened for the butcher. They belong to the "boarder" class, and usually consume more fodder than a heavy producer. Too many animals of this class impair the efficiency of the farm.

No matter how close a watch is kept, it is almost impossible to pick the lowest producers without systematic testing over the whole lactation period. If the farmer is prepared to do this himself well and good, but he requires to have an accurate knowledge of testing and the principles involved in calculating results.

The Department of Agriculture and Stock offers a herd-testing service which involves the dairyman in no monetary expenditure whatsoever. In other States and countries up to 6s. per cow is paid for a similar service. Surely it is impossible to believe that dairy farmers in other parts pay for something that is valueless.

In Queensland many dairymen have availed themselves of the services offered, and the results achieved by those who have tested and culled over a number of years have proved that it is well worth while. Nevertheless, there are very many more who could do so to their own advantage.

To obtain this service it is only necessary to make application to the Department. Sample bottles in a box are sent to the farmer, and all he has to do is to weigh each cow's milk and place a sample in a bottle, as directed. Then, if the factory he supplies is co-operating with the Department, he forwards the box of bottles containing the samples to that factory. Otherwise he may send his samples direct to the Department of Agriculture and Stock, which pays the rail freight.

The testing is done five times at intervals of, approximately, sixty days, and at the end of the period the farmer receives a complete return showing the relative value of each cow under test. It must be remembered that the object of testing is not so much to find out the best cows in the herd as to find out the worst and least profitable.

Testing is only half the job, and the Department depends on the good sense of the farmer to see that he does not keep feeding unprofitable cows indefinitely. Testing is of no value in raising the standard of production of the herd unless the low producers are culled regularly.

It is a poor farm that cannot afford to dispose of the two least profitable cows each year. Remember the first loss is the least. The longer the "boarders" are kept the more expensive they become. They eat the feed of a good milker and much time is wasted, frequently, in rearing their calves, which turn out no better producers than the dams.

UNPROFITABLE COWS.

L. VERNEY, Instructor in Dairying.

ONE has heard the subject of marginal and submarginal profits and marginal and submarginal land discussed frequently. Marginal land may be described as land that returns about enough to pay its way. The return from submarginal land, however, is less than that.

Applying these terms to dairy cows, the records show that dairymen are feeding and milking many marginal and submarginal cows; in other words, cows which barely pay their way and those which are actually milked at a loss. The owner of submarginal land is a slave to his land, and the owner of submarginal cows is a slave to his dairy herd. One is land poor and the other is cow poor.

The question might be asked by those concerned: At what production level does a cow become submarginal? That depends on many things. To the man who relies on the family cow for milk and butter for his family, there may be no apparent marginal production level; but to the man who owns and milks a dairy herd for his livelihood the marginal production level should be comparatively high. Even for the commercial dairy herd, the marginal production level is not constant. It varies much from time to time and from place to place. It is influenced by cost of feed and labour, by price of product (butterfat), and by the distance from the manufacturing centre; yet in a general way each dairy farmer should establish a production level, or a standard below which no cow in his herd can fall and still remain in the herd. On the average the dairy cows in this State produce yearly about 2,500 lb. milk, containing 125 lb. butterfat. That being the average, it may safely be assumed that one-half of the dairy cows of this State produce less than that. Do these cows produce a profit? Do they earn enough to pay for labour and overhead expenses? Can it be true that half our dairy cows are submarginal? The answers can only be given by dairy farmers. In some of our pure-bred herds there are cows that are certainly producing quantities very much in excess of the figures quoted.

A very earnest endeavour must be made to raise our standards by a comprehensive system of herd testing. It behoves all connected with dairying to give more serious thought to this aspect of the industry.

It must be acknowledged that unless this great industry is built on a sound basis all the system and efficiency methods which may from time to time be introduced will never give it the stability so necessary to make it what it should be, not only to the State, but to every individual dairy farmer. The ultimate success of dairying depends largely on a satisfactory production per cow being established throughout the State. So let the dairyman's slogan be "Breed from the best and cull the rest."

AGRICULTURE ON THE AIR.

RADIO LECTURES ON RURAL SUBJECTS.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by Officers of the Department of Agriculture and Stock.

On Friday of each week a fifteen minutes' talk, commencing at 12.45 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures until the 30th April, 1937.

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Friday, 5th February, 1937—"The Importance of Type in Queensland Merino Flocks," by J. L. Hodge, Instructor in Sheep and Wool.

Friday, 12th February, 1937—"Fat Lambs in Queensland," by J. L. Hodge, Instructor in Sheep and Wool.

Friday, 19th February, 1937—"Increase your Return from Eggs. How it can be done," by P. Rumball, Poultry Expert.

Friday, 26th February, 1937—"With the Flock in February. Points for the Poultry Farmer," by J. J. McLachlan, Poultry Inspector.

Friday, 5th March, 1937—"The Harvesting of Cotton," by R. W. Peters, Cotton Experimentalist.

Friday, 12th March, 1937—"Plant Nutrition," by E. H. Gurney, Agricultural Chemist.

Friday, 19th March, 1937—"Sheep Management under the Varying Conditions in Queensland," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 26th March, 1937—"The Care of the Flock," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 2nd April, 1937—"Winter Pastures," by C. W. Winders, Assistant (Agronomy).

Friday, 9th April, 1937—"Pork Products as Regular Items on the Menu," by E. J. Shelton, Senior Instructor in Pig Raising.

Friday, 16th April, 1937—"Some Poultry Farmers' Problems. What to Breed and How to Breed," by J. J. McLachlan, Poultry Inspector.

Friday, 23rd April, 1937—"Strawberry Planting and Other Seasonal Fruit Hints," by H. Barnes, Director of Fruit Culture.

Friday, 30th April, 1937—"Wheat Improvement in Queensland," by R. E. Soutter, Agricultural Research Officer.

FEEDING BACON PIGS.

E. J. SHELTON, Senior Instructor in Pig Raising.

OWING to conditions associated with the prolonged dry spell of weather in Southern Queensland, and to the fact that the price charged for pig foods of all descriptions is at a higher level than usual, many pigs arriving at bacon factories are not in the primest of condition. When slaughtered their carcasses dress out soft, slightly discoloured, and, on grading, are classed as of other than the choicest grade; in fact, some are very fat and too heavy.

In some instances the fat is soft and oily, and in others it is of a slightly yellowish colour and will not "firm up" during the chilling process. If used for small goods, this soft, oily, discoloured meat still carries objectionable features. The loss to the industry through this trouble, plus the lower condition of many of the pigs that kill out to advantage, must be very heavy, for it is impossible to expect factories to pay top prices for second or third grade carcasses.

The Department of Agriculture and Stock, therefore, offers the following advice to farmers, especially in districts south of Rockhampton:—

Soft Oily Pork.—Although several foods may be responsible for this soft condition, all the evidence points to the fact that the chief cause of the trouble is the feeding of peanuts to pigs which are being finished or topped up for the market. Maize and other grain foods are, at present, relatively scarce and high priced, and as peanuts produce particularly fast growth in pigs, farmers are naturally tempted to use them in place of grain. The position could be relieved if pig raisers would concentrate their peanut feeding on the breeding stock and young store pigs, which will make very good use of surplus peanuts, and then other foods available could be kept for the pigs from the store stage until they reach bacon weights. Separated milk, root crops, pumpkins, lucerne (either as green fodder, hay, or chaff), and small quantities of pollard, meat meal, and pasture can be used to make up good rations in the absence of maize.

Yellowish-coloured Pork.—It is known that the probable cause of this condition is an excess of carotin, a colouring matter in plant life, and which is present especially during the early life of the plant and at the stage when (as in the case of pumpkins) the crop is fully ripe or over-ripe. The feeding of an excess of green wheat, oats, or barley, in the absence of, or short supply of, milk may also be responsible; so also may the continuous use of grass or of lucerne as the principal food.

Low-conditioned Pigs.—Lack of condition is, of course, invariably due to lack of sufficient nutritious food. When pigs are in such a condition they become more liable to infestation by internal and external parasites, which irritate the animal and cause much restlessness, especially at night.

It is better to keep fewer animals and to feed them properly than to attempt the keeping of more than the number for which food is available, and it is better to market the pigs when light and prime than to carry them on to heavier weights with loss of condition. Where milk is in short supply meat meal may be used as a substitute, and in all cases the pigs should have clean drinking water and charcoal.

Bruised and Damaged Pigs.—Where pigs are weakened as a result of lack of condition and where they are soft in texture—the result of improper food—they bruise more rapidly, and tend to be more discontented. The only way to avoid bruising is to have the animals in the primest of condition (not over-fat) and to treat them kindly and not force or beat them when loading or unloading. Avoid knocking them or forcing them through narrow gateways or over rough stony yards.

Over-fat Pigs.—Despite dry weather and high priced foods, there is still an abnormal proportion of over-fat and very heavy weight stock coming forward. Pigs should not be fed too heavily on grain, but be kept growing and be given abundant exercise in grassy pastures. It is a mistake to keep pigs penned up continuously in small sties and bare yards. The use of flesh-forming foods like milk, meat meal, lucerne, greenstuff, &c., and mineral matters will tend to overcome any tendency to over-fatness.

THE ZEBU CROSS.

The experiment of the Zebu cross now being carried out in the Central District is reputed to be pleasing to those who made the venture, and although another year or two must elapse to allow the progeny to reach maturity and the beef to be placed on the English market, the results are awaited with keen interest.

Previous experiences indicate that the progeny mature earlier than any other breed or cross, and from birth will increase in weight much more quickly; thus it is possible for the beef to reach the market months in advance of other beef.

Other factors in its favour are that it is not no susceptible to diseases and tick infestation; it is a better " doer " in times of drought, being a quick mover " on the leg," which enables the Zebu cross to reach feed and water in much less time than ordinary cattle, and so retain condition for a longer period. The Zebu cross-bred animal never loses the wild or natural instinct, which probably accounts for its grazing when other animals are resting.

Some thirty years ago a number of Zebu bulls were imported into Queensland and mated with Shorthorn cows, and the beef was highly commended on the English market. The progeny should be crossed back to herd bulls—preferably with Shorthorns, because they are more docile, throw off better colours and conformation.—M. J. B. ASHE, Inspector of Stock.

SOME TROPICAL FRUITS.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

No. 14.—THE STAR APPLE.

THIS tree is one of strikingly ornamental foliage, but in spite of its decorative value it seems to have been very infrequently planted in places beyond its native habitat. In North Queensland only one specimen is known to the writer.

The tree originates in Central America and the West Indies, where it is stated to be of frequent occurrence in the natural forests, as well as being commonly cultivated in home gardens. It grows to 30 to 50 feet in height, and is of open, rather straggling habit. The foliage is peculiarly striking, the upper surface of the leaves being dark olive green and glossy, and the under surface reddish-brown with a satiny sheen. The young shoots are of similar appearance to the under side of the leaves, and all the satiny portions are heavily pubescent.

The tree breaks into young growth during the winter months and makes a rapid growth. Flower buds are then immediately produced on this new growth and are usually plentiful by the end of July. They are, however, very small and may be easily overlooked. The flowering period extends over a month or two. The fruit is bright-green with a smooth glossy skin while it is growing. When ripe it may be either green-skinned or dull purplish. The colour of the ripe fruit seems to be the sole distinguishing mark between two races or varieties of this tree. Flavour and other characteristics of the two races are reported to be the same. When fully grown the fruit reaches about 3 inches in diameter and is round to oblate in shape. On cutting the fruit transversely, the half-section demonstrates the origin of the common name. Radiating from the central axis of the fruit some eight segments of whitish translucent pulp are arranged. These segments, each of which normally contains one seed, form the characteristic star from which the

fruit is named. It usually happens that several segments are abortive, and consequently they are smaller than their two or three neighbours, which carry fully developed seed. The seed is commonly ovate or elliptic in outline, is rather flattened, and about ½ inch in length, and has a hard brown shell or skin.

Plate 60.
The Star Apple Tree.

Surrounding the segments mentioned above and between them and the skin of the fruit is a layer of rather dry flesh of similar colour to the skin. Both this flesh and the flesh of the segments is edible, and both have a sweet flavour, with acidity entirely lacking. Like other sapotaceous fruits, the Star Apple contains a milky latex when immature, and consequently must be allowed to mature fully before it is harvested. In fact, the flavour of the fruit is really at its best if the fruit is allowed to ripen on the tree. In Queensland the ripening season is January and February. The Star Apple is primarily a dessert fruit, but occasionally is preserved or made into sherbert.

The tree is commonly raised from seed, which germinates best when sown in a light sandy loam. Unlike the seed of many tropical fruits,

those of the Star Apple retain their viability over a period of several months, and consequently may be easily transported from one country to another. Considering this, it is indeed remarkable that the tree is not more widely distributed through the tropics than is the case. As seedling trees vary considerably in productivity and other desirable characteristics, asexual methods of propagation are preferable. P. J. Wester has demonstrated that shield budding may be successfully practised on them by using non-petioled budwood, cutting the buds 1½ to 2 inches long and inserting them in that portion of the stock having a similar appearance to the scion. Well-ripened cuttings of the tree are also reported to root successfully if bottom heat is used.

Plate 61.
Star Apple Fruit About Half Grown.

As the Star Apple is in active growth during the greater part of the year, it is necessary that it should be grown in a climate having a fairly high temperature throughout the year. Cold winters are definitely deleterious. Humid atmospheric conditions are most favourable. As regards soil, the tree seems to have cosmopolitan tastes, as Popenoe reports that it thrives well on both shallow sandy soils and deep clayey loams in America. Probably good soil moisture is one of the main factors of the soil aspect.

Star Apple seems to be the common name of the tree in all English-speaking countries. Spanish countries use the specific botanical name "Caimito." The botanical title is *Chrysophyllum caimito* L., and the tree is of the order Sapotaceæ.

PASSION FRUIT GROWING ON THE SOUTH COAST.

J. McG. WILLS, Fruit Branch.

ALTHOUGH passion fruit growing may not attain the same importance as banana growing on the South Coast of Queensland, it certainly offers prospects of a reasonably profitable return to those who are prepared to give close attention to the cultivation of the passion vine.

Considerable interest is being evinced by many landowners in the possibilities of passion fruit as a payable crop on land which has been used for banana growing, thus preventing its return to unproductiveness or pasture.

Plate 62.

Rain forest or "Scrub" land cleared for planting. Note the use of logs to assist in conserving surface soil.

The common purple passion fruit (*Passiflora edulis*) is the principal variety grown and has been cultivated commercially in Australia for over forty years, but its cultivation in most other countries has not become one of great commercial importance, due mainly to natural climatic difficulties. It cannot be grown in Britain or Canada, while in California its cultivation is negligible. Outside Australia the largest cultivated areas are in South America.

There is a regular demand for passion fruit products. Its delicious flavour has secured for it a wide demand as a dessert fruit, and its suitability as an addition to preserves, jams, and fruit salads has earned great popularity for it within the Commonwealth, and the demand is increasing. The increasing use of pure fruit juices in the manufacture of cordials has created such a regular demand that future market prospects are very encouraging.

Large areas of land are being put under passion vines with the object of processing the pulp for export overseas; while the prices paid for passion fruit on the fresh fruit market can be described, by comparison with other classes of fruitgrowing, as highly satisfactory.

Progress should be moderately slow and soundly based. The prospective grower is recommended to commence with a small area, which may be increased when he feels competent to handle an increased acreage. The best results are obtained by those who are willing to specialise in passion fruit growing, and only those who are prepared to apply the energy the industry demands are recommended to engage in it. Disappointment and possibly disaster will result from hit-or-miss methods. Four or five acres of vines is the maximum area one man can attend to if horse-drawn or mechanically driven cultivators are to be used. On less accessible sites where cultivation must be all accomplished by hand, for efficient working the area must be substantially reduced; and an area of two or three acres will be found quite large enough to occupy the full time of the grower.

Plate 63.
Another view of a "Scrub" clearing with trellis posts in position.

Departmental bulletins dealing with the very important subject of passion fruit diseases and their control are obtainable free on application to the Under Secretary, Department of Agriculture and Stock, William street, Brisbane, B.7.

Climatic Conditions.

The South Queensland coastal climate is eminently suitable for passion fruit growing, as the vine grows and thrives in warm humid conditions, such as are experienced in the coastal area. Unfortunately,

fungus diseases, such as brown spot, which attack the aerial parts of the vine, also thrive under similar climatic conditions.

Under normal seasonal conditions, the general heavy rainfall assures sufficient soil moisture during the greater part of the year, the exception being perhaps in early spring. However, by proper cultural methods provision may be made whereby the vines can withstand dry weather without appreciable loss of vitality.

In this region frosts occur on flat and low-lying land, but severe frosts are rarely experienced on higher country. When selecting land for passion fruit growing this fact should be kept in view. Light frosts will do little harm to the vines, but a severe cold snap may affect this plant so badly asto kill all the top growth.

Plate 64.

Sloping land prepared by hand labour. Note the logs laid across the face of the hill, to minimise soil erosion.

Coastal winds and their effect on the plant must also be considered, for a heavy blow may cause appreciable damage to vines, fruit, and trellis. Cold winds affect the blossoms and the setting of the fruit, while hot dry winds promote excessive transpiration, resulting in the shrivelling, marking, or bruising of hanging fruit, lessening its attractiveness when ripe and reducing it in grade. In some localities strong winds accompanying heavy rain may also cause a collapse of trellis with consequent loss of fruit, expense of re-erecting the trellis, and increased spraying costs in respect of the control of brown spot, which spreads rapidly when the vines are lying on the ground.

Cropping Habit.

The passion vine bears its fruit on the current year's growth. This growth is produced mainly from year-old wood. Under average conditions, vines flower during August, September, and October. The blossoms are formed at consecutive nodes along the new growth on young leaders and laterals. The age at which the vine commences bearing depends on its strength and vigour; also on the season of planting. Vigorous plants commence to bear earlier than the less robust ones, and may bear a few fruits at from five to six months. As a general rule, however, when the vines are planted in early spring the first crop of any commercial importance will be harvested in from twelve to fifteen months from the time of planting. If planted late (in March and April) profitable crops may not be harvested until after 18 to 24 months have elapsed. Ordinarily the vines reach maximum production in from two to two and a-half years. From then onwards they decline gradually, yielding less each subsequent year until at from four to five years old the vines become unprofitable commercially. The old vines should then be removed and the area rested, replanted, or used to produce alternative crops.

Plate 65.

Young seedlings two months after planting. Observe the width between the wires on the trellis, and the solid wind-break at the rear.

As it takes approximately ten weeks from the time the fruit sets to the time of harvesting, marketing of the summer crop commences from about October and may extend to January, with the heaviest pickings during November and December. The subsequent crops produced—intermediate and winter crops—depend on the amount of new growth put out by the vines. This growth is influenced by seasonal conditions, health of the vine, and the quantity of fruit produced by the previous crop.

Heavy cropping retards the production of new growth, as the energy of the vine is absorbed in supporting fruit until it reaches maturity. More or less continuous growth, however, has been known during some seasons, with its consequent production of a certain amount of flowers and fruit throughout the whole year. Such habits are not normal, however, and have the effect of preventing the production of a definite seasonal crop. Provided the summer crop is normal and allowed to mature, and seasonal conditions have been suitable, new growth is likely to appear during November and December. The production of this growth is particularly noticeable immediately following the removal of the summer crop. This new growth is more often produced on young vines up to two years old than on older vines. On the new growth blossoms appear which provide the intermediate crop. If the summer

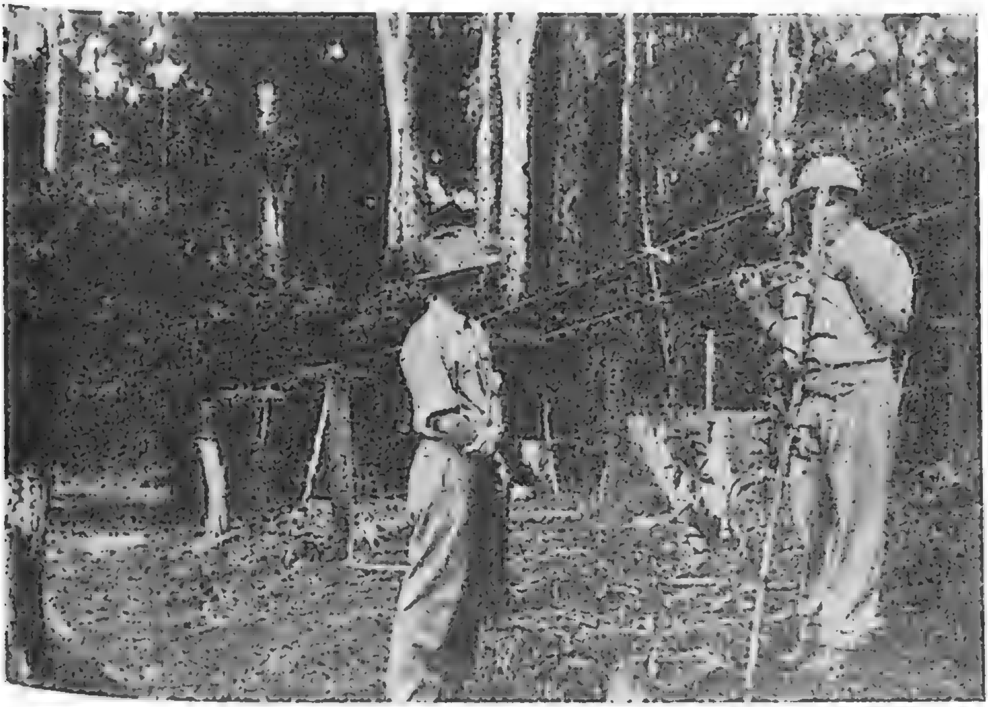


Plate 66.
A horizontal trellis having 2-ft. spreaders. Note the development of twin stems.

crop has been normal and allowed to mature, this intermediate crop is, however, rarely very heavy. If the summer crop is removed or pruned while still immature the vines will then put forth vigorous new growth in November and December, and a larger and more satisfactory intermediate crop will result. Winter crop fruit is set when the vines blossom in February and March, and this crop should be harvested during the latter end of May, on to July. The season at which the vines blossom, and the length of time the fruit takes to mature are influenced greatly by warmth of locality and site, as well as altitude.

Fruit produced under warm growing conditions is less subject to woodiness or "bullet disease"; consequently the fruit is of better quality, and production and market returns higher.

[TO BE CONTINUED.]

CITRUS CULTURE IN QUEENSLAND.

R. L. PREST, Instructor in Fruit Culture.

[*Continued from p. 92, January, 1937.*]

Cultivation.

Differences of opinion which occur concerning the best method of cultivation for citrus fruits may be partly explained by the fact that soils vary in character and in the amount of moisture and fertility they contain. The systems adopted must, therefore, necessarily vary somewhat in order to meet the requirements of the particular soils.

In Queensland cultivation is an essential orchard operation, and is beneficial in the following ways:—

It improves the physical condition of the soil by making it finer and increasing its depth, thus presenting greater feeding areas to the roots.

The effects of extremes of temperature are reduced, as air is permitted to penetrate to the roots.

Plate 67.

NEW ZEALAND LUPINS.—Tops wet:—36 tons to acre. Roots:—4.8 tons to acre.

In cultivated soils decomposition and nitrification go on more readily, and if materials are present from which nitrogen can be set free, its liberation takes place more rapidly than if the soil is uncultivated.

It increases the water-holding capacity of the soil and conserves moisture.

Plate 68.
New Zealand Lupin—Note Root Nodules.

Plate 69.
An Orchard Cover Crop.—Note the cultivated strip along each side of the tree row.

On the other hand, the fact must not be lost sight of that cultivation may cause injurious effects. Unless care is used, plough-sole may result, and greatly hinder proper water penetration. Also, continous cultivation causes the destruction of the organic contents of the soil, and a decrease in the bacterial life. If cultivation is continued throughout the whole season year by year, such soil will soon become depleted of its natural fertility, and the trees will show the effects by their unhealthy condition.

Plate 70.
A WINTER COVER CROP.—Field Peas and Barley.

The loss of soil organic matter is a major problem in tropical agriculture in all parts of the world, and is particularly severe in many of our citrus plantations. Therefore, when considering cultivation programmes, the improvement of the humus content of the soils must be of primary importance. Where young trees are concerned, deep cultivation is advisable in order that large quantities of organic matter, such as manure and green manure crops, can be deeply incorporated with the soil There should be no danger of injury to the roots of young trees in cultivation to a depth of 10 or 12 inches. However, as the trees become older, their rooting systems extend widely in all directions, and, therefore, as deep cultivation will be liable to cut too many feeding roots, shallower cultivation will probably be more satisfactory.

In order to prevent the formation of plough-sole, cultivation at varying depths is frequently practised. However, plough-sole will form in many soils even though the depth and direction of the ploughing is varied, and in such cases subsoiling to a depth of from 18 to 20 inches may have to be resorted to in order to break up any hard pan that may be present. Such work should only be done when the soil is dry, and the subsoiler should be run only in the middle of the rows,

otherwise severe root-cutting will result. Subsoiling should not be carried out either just prior to or just following the blossoming period.

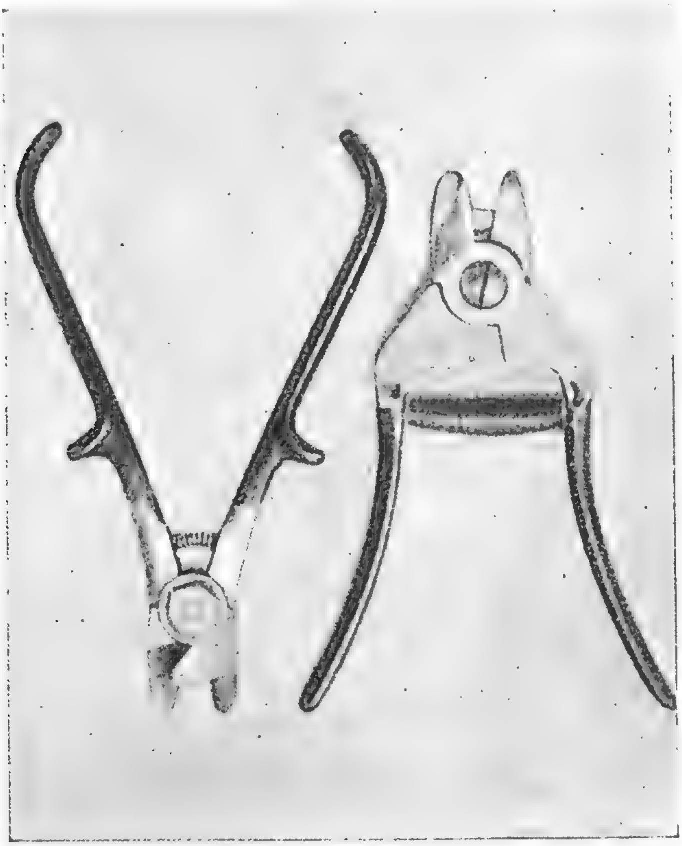
Green Manuring.

Humus, the product of the decay of organic substances, is one of the most important ingredients in any fertile soil, and, generally speaking, is present in only inadequate amounts in most of our citrus soils. Except in alluvial lands periodically improved in fertility by floodings, the orchardist must consider the maintenance or improvement of the soil fertility if he wishes to harvest good crops. In the absence of

Plate 71.
WINTER COVER CROP.—Young Tick Beans.

bulky organic farmyard manure, the maintenance and improvement of the soil fertility may be carried out by the growing and turning-under of green manure crops. Not only do such crops build up the physical condition of the soil, but their presence reduces soil losses by erosion during periods of heavy rainfall. When green manuring, particularly in the coastal districts, the general practice has been to utilise the summer rainfall, planting such crops as black cowpeas, Poona peas, and Crotalaria during November and December, and turning them under about the following March. Winter green manuring with crops such as beerseem (Egyptian clover), vetches, field peas, tick beans, lupins, rape, and mustard could in many instances be practised with advantage particularly in young orchards, and in orchards on the lighter, sandy soils, and where irrigation is practised. For winter crops planting should take place during March and April, and turning-under in July. Citrus trees up to four or five years of age occupy a relatively small proportion of the total area on which they are planted, and their roots do not

extend so far from the trunk nor take up the amount of space occupied by those of old-established trees. Thus during the early years of a citrus orchard an excellent opportunity is afforded for building up a reserve of vegetable matter in the soil. At this stage cultivation, even early in the season, may be confined to the immediate vicinity of the trees, and by far the greater amount of space down the centres of the tree rows occupied by growing and turning under summer and winter green manure crops.



[From photograph by H. Clarke Powell in "The Culture of the Orange and Allied Fruits."

Plate 72.

Clippers designed to minimise injury to the fruit.

Fertilizing.

In reasonably fertile lands the addition of artificial fertilizer to the soil either before or at the time of planting is unnecessary, but in land that has been previously cropped or which would not be classed as fertile, assistance to the growing plants in this direction is required. No matter what fertilizer is applied, it should be incorporated with the soil so that the young roots in traversing the soil may come in contact with it. However, it should not be brought into direct contact with existing roots at the time of planting.

As the trees develop, the quantity of fertilizer required for each will correspondingly increase, and when fully developed an evenly-continued, regular supply is necessary. As crops are produced, so the natural fertility of the soil is being depleted, and where it has not

been restored by the application of such fertilizer as is available, the effect is shown by impaired vigour of the trees and poorer quantity and quality of the fruit produced. General observations made from field trials indicate that nitrogen is one of the main constituents required to maintain healthy and vigorous citrus trees, but at the same time phosphoric acid and potash have their place. At least 6 cwt. of ammonia to the acre, with 3 cwt. of phosphoric acid and 2 cwt of sulphate of potash, would be a basis for a fertilizing programme for mature bearing trees. The nitrogen is best supplied so as to be available during the spring, as such practice tends to increase the crop and improve the quality. Whether or not an autumn application will be necessary will depend upon the vigour of the trees, as it must be remembered that the promotion of too much vigorous growth at this period is detrimental to the production of high-grade fruit. However, it will be found that a light dressing of nitrogen, with rather increased quantities of phosphoric acid and potash, will assist in maturing autumn growth and future fruiting wood, and will also benefit the crop.

The value of lime in citrus culture may be viewed from two angles,—its influence on the trees, and its effect on the soil. The presence of lime appears to aid the vigour of the trees, and improve the delicacy of the fruit, while in the soil it corrects acidity, improves the physical condition, aids the decomposition of organic matter, stimulates bacterial activity, and generally assists in improving soil fertility. Lime should be applied in the autumn in the form of agricultural lime, as its action in the form of powdered quicklime or air-slaked lime is too rapid and powerful.

Harvesting.

The subject of careful handling of fruit has been so frequently stressed that further details here seem superfluous. The chief points to be remembered are that the fruit should be cut from the tree as close to its base as possible (an orange clipper specially made for the purpose is available at a nominal cost), and that it should be treated as fragile during the first and all subsequent handlings, and carefully stored and graded before packing. Various grade sizers are obtainable, and selection can be made according to the output of the orchard. Wrapping the choicest fruit when packing enhances its appearance and increases its value, besides having other advantages, such as prevention of the spread of storage and transit diseases. Fruit should be gathered only under the driest possible atmospheric conditions, and never, as is often done, during showery weather. It should be sweated for at least seven days, and then carefully graded for blemishes and disease, sized, and packed.

Colouring.

No fruit should be gathered from the trees until it has reached maturity. The maturity standards for citrus fruits are as follows:—

In the case of oranges, grape fruit, and mandarins, the weight of the hand-pressed juice must be not less than 30 per centum of the total weight of the fruit.

With regard to the juice, in the case of navel oranges and mandarins, 10 cubic centimetres of the juice shall be neutralised by not more than 26 cubic centimetres of deci-normal (N/10) alkali; and in the

case of oranges (other than navel oranges and mandarins) 10 cubic centimetres of the juice must be neutralised by not more than 30 cubic centimetres of deci-normal (N/10) alkali.

As citrus fruits are only sold to their best advantage when they are mature, full-flavoured, and showing an unblemished skin with its normal ripe colour, assistance by colouring to such fruit as lack normal colour but possess the other qualities will enhance its market value. Citriculturists who have had experience in various citrus-growing localities will agree that certain varieties of oranges and mandarins growing in the cooler regions have ample colour long before they attain sufficient sugar to make them desirable for eating purposes, while those produced in warmer climes are sweet and luscious for some time prior to their attaining a normal ripe colour.

The colouring or forced curing, a practice known in California as "sweating," was formerly done by gaseous products generated from kerosene stoves. In 1924 Denny found that ethylene gas in small quantities was capable of producing the same results. He also found, however, that a very high percentage of gas (for example, 80 per cent.) delayed colouring. Colouring was also delayed by temperatures as high as 92 degrees Fahr. and as low as 45 degrees Fahr. A temperature of between 60 and 70 degrees Fahr., with a humidity of from 70 to 75 per cent. was found to be satisfactory.

Ethylene gas can be obtained in metal cylinders under a high pressure, with regulator valves attached to the cylinders. When released from the regulator valve the gas is conveyed by tubing into the colouring chamber. The quantity of gas passing into the room is recorded by the valve on the cylinder, so that the correct charge according to the size of the chamber can be readily determined.

It has been found that a very small quantity of acetylene gas (1 part in 2,500 to 1 part in 1,875) satisfactorily colours mature citrus fruits. In order to determine the dosage required, the air space remaining after the chamber has been loaded must be known. One ounce of carbide generates sufficient gas for every 75 cubic feet of air space. For all practical purposes it is sufficient to allow $1\frac{1}{4}$ cubic feet displacement for each bushel case of fruit. For example, the following table illustrates the dosages required for a chamber of 200 cubic feet capacity with a varying number of cases:—

No. of Bushel Cases.	Air Space.	Dosage.
40	150 cu. ft.	2 oz. Carbide
20	175 cu. ft.	$2\frac{1}{3}$ oz. Carbide
10	$187\frac{1}{2}$ cu. ft.	$2\frac{1}{2}$ oz. Carbide

In order to satisfactorily colour citrus fruits, they must have reached maturity, as if too green or immature they will not develop a normal ripe colour, but will shrivel and become dull and dirty in appearance.

All fruits to be coloured require to be treated with special care in handling. Bruises will show up as greenish areas; oil liberated from the rind may cause spotting; while if the residues of oil or Bordeaux sprays remain on the fruit, it will be found to come from the colouring room spotted and unsightly.

Any ordinary room lined with timber, provided it is air-tight, can be used for colouring citrus fruits. A convenient and economical size is one to hold from 40 to 50 bushel cases; allowing 5 cubic feet of air space to each bushel case, the chamber would require to be from 200 to 250 cubic feet in capacity. Even where large numbers of cases are to be treated, it will be found more satisfactory to build two medium-sized chambers than one large chamber.

For oranges, lemons, and mandarins an average temperature in the chamber of between 65 and 75 degrees Fahr. will prove satisfactory. If the temperature falls below 65 degrees Fahr. the colouring process will be retarded. On the other hand, high normal temperatures are not likely to affect the fruit, no ill-effects having been shown by temperatures up to 89 degrees. However, the humidity will require to be adjusted; in the case of a very dry atmosphere an open container of water may be introduced to moisten the air and prevent withering of the fruit; while when the humidity is high and likely to cause softening of the fruit, it may be reduced by placing sand, caustic soda, or quicklime on the floor of the chamber.

The fruit should be graded for colour and placed loosely in open cases having plenty of ventilation. Dunnage should be used in stacking so that a free circulation of air around each case is permitted.

The required quantity of carbide should be placed in a suitable container, and a second vessel containing water arranged in such a manner as to permit the water to drip slowly on to the carbide, thus generating the acetylene gas. This apparatus may be fitted either inside or outside the chamber; if the latter, of course, the gas will have to be led inside the chamber by means of suitable piping.

After closing the chamber and making sure that it is airtight, it should be charged and allowed to remain close for four hours. It should then be opened up and thoroughly aired for at least two hours, after which it may be charged again, and the performance repeated as often as is necessary. Between nine and fifteen charges should be sufficient to give mature citrus fruits their normal colour.

Picking and Curing of Lemons.

Lemons carefully handled and gathered at the right stage of maturity may be successfully cured and stored on the orchard for several months without deteriorating, but rather with improvement to their appearance and carrying qualities.

All fruits should be clipped, not pulled, from the trees just as they are turning colour. The fruit should be of normal size, and the dark-green colour just turning to a paler shade, generally termed "silvering." In order to avoid injuring or bruising, and thereby leaving the fruit open to the attack of moulds, it is important to remember that it must at all times be handled wih the very greatest of care.

After picking the fruit should be placed in shallow trays and allowed to remain for several days to sweat off excess moisture. When storing for any length of time, dipping for a period of one or two minutes in a bluestone solution, strength 1 in 500, is recommended. The fruit, after being thoroughly dried, is packed in bushel cases and stacked in a storing chamber in such a manner as to permit a ready circulation of air.

Such chamber should be so constructed as to lend itself to control of the relative humidity. A low relative humidity results in the shrinkage of the lemons, with a consequent loss of weight and an inferior colour in the fruit, accompanied by shrivelling, as well as the browning and dropping of the buttons of lemons held in storage for any period. These conditions are mostly apparent during late spring, a period of comparatively high day-time temperatures and low relative humidity. Satisfactory conditions may be obtained by controlling the humidity at from 85 to 90 per cent. For controlling the humidity a humidifier may be cheaply constructed by hanging a series of absorbent cloths from a frame, above which is fixed a small perforated iron water-pipe permitting water to drip when required, and circulating the air in the chamber by means of a small fan. Under such conditions lemons may be stored for several months.

Another method used in storing lemons is, after sweating, to pack the fruit loosely, either wrapped or unwrapped, in cases lined with paper, and stack in a cool dry shed in blocks of from 50 to 60 cases covered with canvas sheets or tents. Low open water containers may be introduced when necessary, always taking care to avoid as far as is possible extreme variations in temperature and humidity. The fruit should be examined at intervals of ten days, and any showing signs of decay removed.

Again the fruit may be stored, either wrapped or unwrapped, loosely packed in cases lined with paper and using straw as a filler. The bottom of the case is covered with a layer of straw, a layer of lemons placed thereon, the spaces between the fruits filled with straw, and the lemons covered with a layer of straw, and so on, using alternate layers of fruit and straw until the case is filled. The cases should be stacked, covered, and periodicaly examined as described in the previous method.

REFERENCES.

The following is a list of principal works consulted:—

H. H. Hume—"The Cultivation of Citrus."
H. Clarke Powell—"The Culture of the Orange and Allied Fruits."
R. W. Hodgson—"The Pruning of Citrus in California."
G. Quinn—"Handbook for Fruit and Vine Growers."
Fawcett and Lee—"Citrus Diseases and their Control."
Lyon and Buckman—"Nature and Properties of Soils."

CROWN LAND FOR GRAZING HOMESTEAD SELECTION. CUNNAMULLA DISTRICT.

174,931 ACRES OF SHEEP LAND—PART OF THURRULGOONIA RESUMPTION.

This land has been surveyed as portions 5, parish of Cotton, 1 and 2, parish of Magie, and 1 and 2, parish of Kumbogan, and will be open for Grazing Homestead Selection at the Land Office, Cunnamulla, on Monday, 8th March, 1937, at 11 a.m.

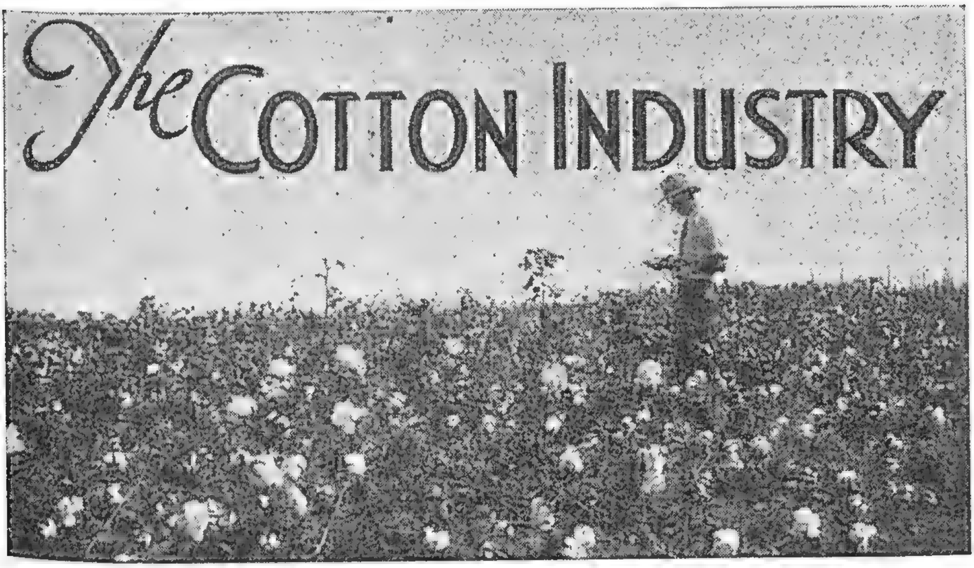
Each selection will be for a term of 28 years.

The annual rentals for the first period of 7 years are from 1d. to 2¾d. per acre.

Each selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of 3 years.

The blocks are all good woolgrowing country and are artificially watered by bore drains, but more water may be required.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane; the Land Agent, Cunnamulla; and the Government Tourist Bureaux, Sydney and Melbourne.



THINNING AND SPACING OF COTTON.

W. G. WELLS, Director of Cotton Culture.

RESULTS obtained from the experiments testing the merits of different spacings of cotton plants, and heights at which to thin them, have indicated that soils and climatic conditions have an important influence in determining what is the best spacing of cotton plants. The habit of growth of the variety also has an effect; so it would appear that no one particular plant-spacing gives the best results under all conditions. It becomes necessary to consider, therefore, what spacing is the most satisfactory under a range of climatic conditions, for each variety on each soil type. This makes it advisable for each grower to carry out spacing tests over a series of years so that the best spacing for average conditions may be ascertained.

One point emerging from the experiments that have been conducted is that cotton must be spaced out to some extent, for the unthinned plants always tend to be more sensitive to climatic conditions. In wet seasons the unthinned plants, if on soils of a fertile nature and of a high nitrate content, grow very tall and spindly, which causes the suppression of the lower fruiting branches, with a consequent delay in the setting of the bolls. The crop thus tends to form rather late and, in addition, is subjected to the sucking insects that occur generally in greater numbers during the latter part of the season, particularly if showery weather prevails then. The lint produced under such conditions is frequently of a rather wasty nature, containing a considerable amount of stains and yellow spots. In dry seasons where the plants are left unthinned, the competition for plant food and moisture soon becomes so acute as to cause the loss of the flower buds, then the small bolls, and finally it restricts the development of the bolls that remain on the plant. This lowers the quality of the fibres contained in the affected bolls, for they do not reach full development, thus resulting in weak, wasty, and shortened fibres.

Although much more data is required in all districts to allow of a decision to be arrived at as to what is the most satisfactory plant-spacing for each variety and soil type, the results obtained indicate that for alluvial soils with varieties like Indio Acala, Miller, New Boykin, Ferguson, and Half-and-Half, spacing to 12 to 15 inches when the plants are 5 to 8 inches tall, can be relied upon to yield about as well as any over a series of years; and the quality of fibre produced is less likely to be affected by adverse climatic conditions. The Durango variety, with its tendency to develop more of a top crop on the large vegetative branches, appears to require wider spacing, particularly in seasons in which wet conditions in the second half are experienced. Spacings of 20 to 24 inches when the plants are 5 to 8 inches tall are, therefore, recommended for it.

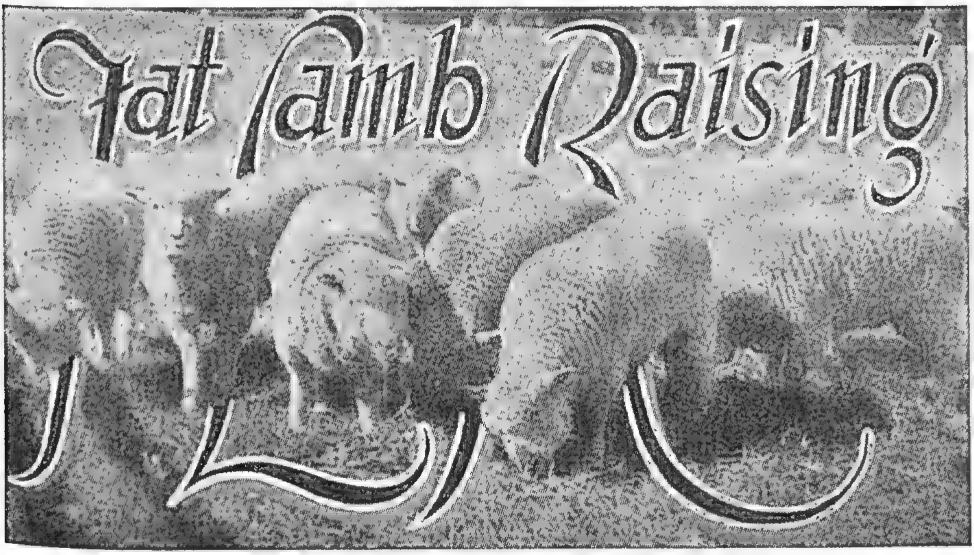
On the harder, less fertile clays and clay loams of the forest slopes —particularly in the drier districts—more drought-resistant, vigorous-growing varieties like Lone Star and Mebane are required. These varieties have produced satisfactorily over a series of years when spaced out to 20 to 24 inches. In a season of late planting, such as the present one, it is possible, however, that around 15 to 18 inches may be more advisable for December-sown plants, as fewer bolls per plant will likely be borne, so that having more plants per acre will tend to overcome the deficiency. The plants should not be left much closer than this in an attempt to compensate for the fewer bolls per plant, for the late plantings of these varieties will tend to grow very tall and spindly if left in a crowded condition, unless on soil of very low nitrate content, or unless rather dry conditions occur for the next two months.

The results of time of thinning experiments indicate clearly that it is best to thin when the plants are 5 to 8 inches tall, as this arrests the tendency for the plants to grow spindly and reduces competition for moisture and plant food; also, if the field has been cultivated and cross-harrowed to eliminate weed growth, the thinning operations can be performed easily and rapidly when the plants are at this stage. These are all important factors in late-planted cotton, which will grow very rapidly at this stage of the season if wet conditions are experienced.

COMFORT IN THE COWYARD IN WET WEATHER.

On many farms the cow yard becomes very boggy in the wet season, and conditions are then anything but pleasant for the milker, as well as the cow. The dairyman has to walk through mud and slush, sometimes up to or over his ankles, and the cows often drag their udders through the mud when walking into the bail from the yard. Consequently, the mud adheres to legs, udder, and belly, entailing a considerable amount of work in washing both teats and udder. If this cleansing job is not done correctly and thoroughly cream of inferior quality is delivered at the butter factory, for which only second-grade price can be paid.

To ensure comfort in the cow yard in wet weather, a small enclosure, 36 feet long and 36 feet wide, may be constructed. This small yard should be concreted. Sand and stone can be obtained quite handy to the farm as a rule, so the work can be done by the farmer at the cost of the cement. Dairy farmers who have adopted this idea declare that they wonder why they did not build such a "draining yard" before. It makes all the difference in the comfort of wet weather milking. A yard 36 feet by 36 feet will hold twenty cows quite comfortably.—D. A. LOGAN, Inspector of Dairies.



FAT LAMB BREEDING.

J. L. HODGE, Assistant Instructor in Sheep and Wool.

RECOGNISING that Queensland generally lags behind other States in the production of fat lambs, the Minister for Agriculture and Stock some time ago inaugurated a scheme for the encouragement of this branch of the sheep industry. Rams of British breeds were purchased in the South and distributed to farmers who had cultivation or promised to cultivate. The necessity for cultivation was urged on all farmers, it being thought by officers of the Department that fat lambs off grass country, even if prime, were more or less in the nature of a fluke. The breeds purchased were Border Leicesters, South Downs, Dorset Horns, Shropshires, and Romney Marsh.

In certain cases where a farmer owned a stud ram of particular breed, stud ewes were supplied with the idea of fostering the breeding of pure stock.

All sheep supplied to farmers are on loan, and remain the property of the Department. The progeny and wool, however, are the property of the farmers concerned.

The interest taken in the scheme, and the results to date, have been highly gratifying, and it is now no uncommon sight to see a pen of true sucker crossbred lambs on sale at Cannon Hill. Prices, too, during the period under discussion have been generally profitable.

The greatest drawback to the production of fat lambs on the Darling Downs in quantity has been in the past and still is the difficulty of purchasing good crossbred ewes as the mother flock.

If a start has to be made with Merinos the best for fat lamb raising is bred by the introduction of one of the longwools, such as Border Leicester, Lincoln, or Romney Marsh into the strong-woolled, robust type of Merino ewe. The ewe lambs of this drop should then be retained as the future dams of the lamb-raising flock.

As to suitable ewes for the fat lamb industry, it is believed that graziers on the fringe of the Darling Downs or further out would

find it profitable to join long-woolled rams of British breed with their cast-for-age ewes with the idea of selling the progeny annually as fat lamb ewes on the Downs. Into the crossbred ewe flock, as described, should be introduced a ram of the Downs type. Opinions necessarily differ in the matter of crosses. The South Down is the fashionable lamb at the present time, but it should be remembered that this cross must suffer no check from birth to block. The Dorset Horn gives a very nice lamb, early maturing and hardy. The use of the Border Leicester should be encouraged in every way. In addition to an early-maturing lamb filling every want, it must be remembered that the skin value of this lamb is worthy of consideration to a far greater extent than either the Dorset or the South Down.

Pure-bred Corriedale ewes are hard to come by, but should the opportunity occur a farmer would be well advised not to let it slip. Pure Corriedales are hard to beat, good mothers and heavy milkers, besides growing a profitable fleece.

Generally, the wool from a flock retained for fat lamb breeding is a secondary consideration when compared with the production of fat lambs.

CODLING MOTH CONTROL.

The overwintering codling moth grubs are now assuming the chrysalis form, and a general emergence of moths may be expected to commence shortly.

A final inspection of packing sheds should now be made, and as many grubs and chrysalids destroyed as possible. It is of course impossible to obtain anything like a 100 per cent. kill of the grubs that harbour in the packing shed, but by careful searching many can be found and destroyed.

Second-hand cases or any cases stored in the shed should be dipped in boiling water for a period of three or four minutes, and this will kill all the grubs harbouring in joints and nail holes.

Although it is generally recognised that the packing shed is an important source of moth infestation each season, quite a large percentage of grubs also overwinter in the trees in the orchard, and they may be found in all sorts of cracks and crannies under the bark at the base of the trees, and at the juncture of the larger branches and in the main crotch or fork of the tree, and the time spent in searching for and destroying these grubs is well spent.

All growers should now set out a few bait traps as indicators of moth activity, as in this way fairly reliable information as to when the eggs are being laid can be obtained. When the greatest number of moths are found in the traps, it can be safely assumed that the greatest number of eggs are then being deposited, and as the eggs hatch in from five to ten days, according to temperature, information in regard to the timing of sprays can be thus arrived at.

Bait pans should be of about 3-pint capacity, and they should, if possible, be covered with a wire mesh screen or cover made from $\frac{3}{8}$ to $\frac{1}{2}$-inch wire netting. This will prevent the larger moths, such as cutworm moths, from entering the trap and spoiling the bait.

Any wide-mouthed vessel can be used for the trap, the wider the better, and enamel pudding basins of about 7 or 8 inches diameter make very good traps and are easy to fix the hanging wire to, but any tin or glass vessel of a similar diameter will answer the purpose.

One of the cheapest and best baits is made as follows:—

Crude molasses 1 part, water 16 parts.

The molasses is dissolved in the water and the trap about two-thirds filled with the mixture.

The traps are hung as near to the top of the tree as possible, as more moths are caught in this situation.

The hanging is easily accomplished by screwing a couple of screw eyes into one of the large branches near the top, a piece of stout cord is fixed to the wire handle of the trap, and the other end of the cord is passed through the screw eyes, enabling the trap to be easily raised and lowered for daily inspection and resetting when necessary. The trap should hang clear of the branch, and fresh bait should be used about every ten or twelve days.—HUBERT JARVIS, Entomologist.

The Importance of Forests in the Circulation of Water.*

THE part which forests play in the circulation of water on the earth's surface is not yet fully understood. There are many meteorologists and engineers who deny altogether the effect of forests on the amount and distribution of rainfall. The old theory that the source of all our precipitation over the continent is evaporation from the surfaces of our oceans is still prevalent. According to this theory, the vapour from the oceans is carried by the wind to the continent, there condensed in the form of rain or snow, and later returned through rivers back to the ocean. The circulation of water on the earth's surface was thus considered as going on in a somewhat horizontal direction between the ocean and the land.

Bruckner's investigations on the circulation of water in the atmosphere dealt a serious blow to this theory, and threw in bold relief the evaporation from the earth's surface itself as the most important source of our precipitation. According to his calculations, the oceans contribute only two-ninths of the entire precipitation that takes place over the land areas draining toward the oceans; seven-ninths of the precipitation over the earth is derived from evaporation from the land itself.

If evaporation from the land surface is the chief contributor of moisture to the air, it is of interest to know which of the various earth coverings contribute most vapour to the air. Studies of the loss of water from the different earth coverings show that free water surfaces of lakes and streams contribute less vapour to the air than bare, moist soils. Land covered with grass or crops contributes through direct evaporation and through transpiration more vapour to the air than bare, moist soils.

Of all the vegetative coverings, a dense forest contributes most vapour.

Experiments conducted in Germany by Wollny and Ebermeyer, by Henri of France, and by Otozky in Russia, all agree that the ground water is near to the surface in fallow ground, somewhat depressed under agricultural crops, and is lowest under forest cover.

The French aptly call the forests the "oceans of the continent," and compare the vapour given off by them to clouds of exhaust steam thrown into the atmosphere.

The reasons for the tremendous consumption of water by forests are clear. To produce one pound of dry wood substance, from 500 to 1,000 pounds of water must pass through the body of the tree. A forest, if it is fairly stocked with trees, produces at least 100 cubic feet of wood per acre per year, including root and branch wood. A cubic foot

*Abstract of address by Raphael Zon, Director, Lake States Forest Experiment Station, Forest Service, United States Department of Agriculture delivered at a meeting of The Mayo Foundation Chapter of Sigma Xi, Rochester, Minnesota, Friday, 22nd March, 1935. Supplied by Dr. H. Poate, a Sydney surgeon who is also a very keen horticulturist, to "The Fruit World and Market Grower" (Sydney), and printed in that journal for January, 1936.

of coniferous wood weighs on an average 25 pounds; that of hardwood about 40 pounds. An acre of forest, therefore, produces on an average from 2,500 to 4,000 pounds per acre. To produce this amount of wood, from 2,500,000 to 4,000,000 lbs. of water will have to pass through the tree, and be given off into the air. If this water were distributed over an acre of land it would cover it to a height of 12 inches.

Forests, therefore, lying in the path of prevailing winds blowing from oceans to continents enrich the air passing over them with vapour and help in carrying this moisture farther into the interior of the continent. We have in the United States a clear example of this influence in the forests of the Coastal Plain and the Southern Appalachian Mountains. The prevailing southerly winds of the summer, on reaching the shores of the southern States, are drained of the vapour derived from the Gulf of Mexico. In further movement north, they would, therefore, become dry winds, if not for the presence of the forests over which they pass. Passing over large stretches of forest, they become alternately enriched with vapour and drained of moisture, and in such relays the moisture is carried into the central and prairie region, making summer the period of greatest rainfall there.

Lowdermilk, in his recent investigation of the influence of the forest upon rainfall, found that the increasing dryness of the interior of China is brought about by the decreased humidity of the air due to deforestation. This, together with erosion following deforestation, has caused serious disturbance to the entire circulation of water in China.

For the same reason the forests of the Scandinavian peninsula must be important in the distribution of moisture over northern Europe.

Whether the forests actually increase rainfall may be a question, but the part which they play in the distribution of rainfall over the land has a good foundation of scientific facts behind it.

STOCK WATERING FACILITIES.

On many grazing properties in Queensland there is sufficient surface water to last until June or July in a normal year, and possibly until August in a good year, when there has been a heavy wet season. There is a period between the time that the surface water dries up and the first storms fall in which it is necessary to provide water, either by well or bore.

When selecting a site for a well or a bore, the grazier should first make a survey of his country. A site should, if possible, be selected on a part of the property where cattle do not feed intensively when surface water is available. On a number of grazing properties the mistake has been made of putting down a bore in close proximity to the surface water. As the surface water dries up, the grass in the immediate vicinity is also eaten out, and when it is necessary to pump water for stock there is often no grass in close proximity to the bore or well. As a result, the stock are forced to travel a considerable distance out to grass.

When bores and wells are put down in places away from surface water, there will probably be grass near at hand in a dry time, and cattle will do better, drink oftener, and retain condition that they would otherwise lose through excessive walking.—D. A. LOGAN, Inspector of Stock.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, the Freisian Cattle Society, and the Ayrshire Cattle Society, production charts for which were compiled during the month of December, 1936 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Eveline of Alfa Vale	W. H. Thompson, Nanango	15,517·2	708·434	Reward of Fairfield
	JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.			
Alfa Vale Gentle 2nd	W. H. Thompson, Nanango	15,186·9	695·151	Reward of Fairfield
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Sunny View Thelma	J. Phillips, Sunnyview, Wondai	12,310·65	520·374	Lovely's Commodore of Burradale
	JERSEY.			
	JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.			
White Rose of Hamilton	J. Wilton, Junior, Raceview	11,035·75	663·178	Retford Mary's Victor
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Wyreene Creole	Mrs. M. Allom, Toowoomba	7,391·05	380·059	Lyndhurst Majesty
	FREISIAN.			
	SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.			
Ryfield Butterfly	F. C. Noller, Kumbia	10,043·95	407·812	Ryfield Monarch 2nd
	AYRSHIRE.			
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Myola Lady Jean	L. M. Anderson, Southbrook	8,391·86	368·183	Fairview Combination

The Tropics and Man

HEAT AND THE HUMAN BODY.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M.,—Professor of Physiology, University of Queensland.

No. 2.

The Body as a Heat-Producer.

WHATEVER we like to think about the ultimate origin of life and the development of its forms through the ages, this much is certain, that when life was first evolved upon this earth it was committed irrevocably to two principles—the use of oxygen from the air in furnishing energy for work, and the wastage or dissipation, to use the technical term, of much of that energy as heat. Engineers will recognise this latter statement as part of a larger truth which is given the imposing title of the *second law of thermodynamics*, and which entails that energy cannot be transferred from one form to another without the loss of a certain proportion as heat. The human body can be regarded as an engine. It must be provided with fuel in the form of food; it must be supplied with the oxygen of air so that it can burn up that fuel and liberate energy; it has mechanisms for converting some of that energy into work. In many respects it is a peculiar engine in that the burning process is carried out quietly in each of the myriads of body cells without flame and flurry, and that an unusually large proportion of the energy liberated in this process can, upon occasions, be converted into work. Nevertheless, it is an engine, and calls for the same considerations as other more familiar types of engine. I have mentioned the supply of fuel and oxygen, I could add the replacement of worn parts and many other parallels, but the point I want to deal with is the inevitable liberation of heat by the body.

At rest, the average man would set free in twenty-four hours enough heat to raise four gallons of ice-cold water to boiling point. A navvy would produce about two and a-half dozen times this amount in twenty-four hours of his average life. Welcome as this fact is in temperate and cold countries, it becomes something of a burden in sub-tropical and tropical regions. To appreciate this we must consider some further peculiarities of the body.

Body Temperature.

Birds and mammals differ from other animals in keeping their body temperature at a more or less fixed level. For birds and mammals the production of heat is no longer an incidental in life, nor can they leave the opposite process of heat loss to the chance determination of their surroundings. A single man whose wants in life are few and simple may find it possible to live without considering either his income or his expenditure, but a man burdened with the full responsibilities of citizenship knows only too well that to maintain a steady level of affluence he must exercise the strictest control over both. Just so does the human body require to have control over both heat production and heat loss if it is to keep its temperature constant. Just why it is necessary and how it came about is another story, but we shall have to be

content, for the moment, with accepting the fact that the body, to work efficiently, must keep a fairly constant internal temperature of 99 deg. F.

Now, how does the body balance its income and expenditure in the matter of heat? It may seem strange at first if I tell you that, except in very cold weather, the body exercises but little control over heat production. Most of its attention is given to regulating the opposite process of heat loss. It is because of this concentration upon regulating heat-loss that the different climatic factors—temperature, humidity and wind velocity—are of such individual importance. If I am to make myself clear in succeeding articles I must take you a little way into the theory of heat loss.

How the Body Loses Heat.

Heat is lost from the body partly by *radiation*, and partly by *conduction* to surrounding objects cooler than the body. (The difference between these is that conduction requires some material connection with the objects concerned as by air, water, or touch, while radiation does not.) Still more heat can be lost if water is present on the surface of the body and if this can be *evaporated*. A fourth process of *connection*, or movements in the substance surrounding the body (e.g., air movements), helps conduction and often, also, evaporation.

It will be obvious to you that the body can lose heat by radiation and conduction only if the objects around it are cooler than the body itself, and it will appear reasonable to state that, the greater the difference in temperature the more rapid the loss. Thus in winter the body has no trouble whatever in getting rid of all the heat it is producing, just as you and I have no trouble in getting rid of the money we make; in fact, the difficulty is to keep enough in hand. In mild weather, as in good times, it is fairly easy to keep a reasonably steady balance. In hot weather, on the other hand, the body may encounter considerable difficulty in getting rid of all the heat it produces—I am told there are people who experience difficulty in getting rid of the money they make!

It is when the hot weather comes that the human body can make use of something it has kept up its sleeve, as it were—perspiration. At all times there is a certain amount of evaporation going on from the lungs and from the skin surface, but this does not constitute a very large proportion of heat loss in cold weather. As we all know, however, perspiration can be profuse in hot weather, and thus provide ample water for evaporation with consequent loss of heat. One is apt to forget, however, that it is not the sweat which forms big drops on our arms and face, nor the sweat that soaks the arm-pits that is losing heat for us. Visible sweat is largely wasted sweat. It is the sweat that is evaporated before we see it that is so useful. In technical terms, each gram of sweat evaporated gets rid of 540 calories of heat, while each gram of sweat that runs off the body gets rid of only 3 calories. In hot dry climates it is not the rule to see the limbs bathed in free sweat, while that is common enough in the humid tropics; yet simple weighing experiments will show that one loses twice as much sweat by evaporation in the hot dry as in the hot wet climate. One's thirst sensations confirm this.

Evaporation, however, can only take place into air that is not yet saturated with water vapour. In the dry climates, the air contains very little moisture, so that evaporation goes on very readily. It is just as well that this is so, since in those climates, heat loss by radiation and

conduction is reduced to a very low figure, if not actually reversed. In humid climates, evaporation is very much more difficult and the air in contact with the body is quickly saturated, so that it must be constantly changed if evaporation is to go on. It is in humid climates that convection or air-movement is so important.

I think you will agree after this little discussion, which, I hope has not been too technical, that the difficulty the body is up against in the tropics is that of losing heat as rapidly as it is producing heat, and that the difficulties are of three main kinds:—

(i.) The surroundings are not sufficiently cooler than the body to permit of sufficiently rapid heat loss by radiation and conduction (in fact, the flow of heat is at times reversed!).

(ii.) The atmosphere may be so humid that evaporation cannot take place at any great rate.

(iii.) The air in contact with the skin surface may not be replaced sufficiently often so that it becomes saturated with heat and moisture, preventing further loss from the body.

Now these three factors—temperature, humidity and air-movement —are the three cardinal features of tropical climate, and, in turn, of tropical hygiene in so far as it concerns climate. So important are they, and so necessary is an understanding of them, that I shall consider them carefully in the next two articles. I have largely finished with general technical discussions, and shall pass on to more practical points, but, unless you are already familiar with these things, it would be a good plan to put this article aside for reference should some point escape you later.

KEEP COWS IN CONDITION.

There is as much variation in the skill of men in handling cows as there is among cows or men. It is folly to expect improvement in the production of cows unless there is first an improvement in the practices of men who feed and care for the cows.

At this particular time it would be easy to pick out two classes of dairymen by the condition of their herds. One group has found by experience that it pays to keep cows in good condition, and especially to have them in good condition at calving time. The other group, not being alive to the necessity of supplying plenty of the right kind of feed at the right time, and, further, apparently thinking that cows need be fed only while they are giving milk, have cows whose condition is anything but satisfactory at the beginning of a new lactation period. These are the men who should make some improvement in their skill in feeding and caring for cows, if the cows are to make them as much money as they are capable of making.

Pastures have been unusually short in many parts of the State. This means that a lot of cows will not be in proper condition to calve and carry on their next lactation period. There is still time to give these cows a fair chance to make good before they actually settle down to their milk-making task.

Good dairy cows should have from six to eight weeks' rest between the close of one lactation period and the beginning of the next. More than this, they should be fed well enough to permit them to regain what condition they have lost on account of the short pasture. It is a very difficult matter to feed them back to condition after they have calved.

The advice given is:—Look over your cows now and pick out those that need some extra feed, and, most important of all, give it to them. Calving troubles, retained afterbirth, premature calving, are costly. A cow that has trouble in calving will be off at least a fourth for that lactation period. Many of these troubles are due to ill condition, and can be corrected by proper care before calving.—L. VERNEY, Inspector of Dairies.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Elephant Grass.

A.E. (Esk)—

It is rather difficult to be sure of grasses from a single leaf only, but the one sent by you seems to be definitely elephant grass, *Pennisetum purpureum*, a grass cultivated to a fair extent in Queensland and fed to cattle both as chaff and feeding off. We have no records of animals being poisoned by it, and tests by the Agricultural Chemist for the presence of a prussic-acid-yielding glucoside, as in the sorghums, have always given negative results. Perhaps your fowls are getting at some other green-stuff.

White Passion Fruit Vine.

J.H.G. (Woodford)—

Feeding experiments with the white passion fruit vine were carried out by the late Dr. Sydney Dodd at the Animal Health Station, Yeerongpilly. A feature brought out by the investigation was that the poisonous property of the vine is of a cumulative nature, and quite considerable quantities of it have to be eaten before any ill-effects are noticed. Most of the trouble occurs at times when grass is scarce, particularly towards the end of spring and the beginning of summer. Ordinary paddock stock running on well-grassed paddocks which may be infested with the vine do not seem to become affected, or at least not to any extent. It is the leaves that do the damage. It does not matter whether the plant is in fruit or not.

We have some other passion fruit vines possessing a prussic-acid-yielding glucoside, and which may cause the death of cattle that eat heavily of them very quickly. These, however, are not anything like so common as the ordinary white passion vine, the one experimented with by Dr. Dodd.

Scrub Panicum. Caustic Creeper.

"ENQUIRER" (Spring Creek Station)—

1. *Setaria australiensis*, sometimes called scrub panicum, a fairly common grass in parts of Queensland, mostly on the coast or near-coast and very common along scrub edges—hence the local name. It should be quite a good fodder, particularly in its younger stages, as it is very closely related to such well-known cultivated fodders as the giant setaria and the dwarf setaria.
2. *Euphorbia Drummondii*, the caustic creeper. This plant is very common at times in parts of Queensland, particularly on the Darling Downs country. It is reputedly poisonous to sheep, causing the head and neck to swell. If the swelling is pierced an amber-coloured fluid exudes and the life of the sheep may be saved. Most of the trouble occurs with travelling or freshly untrucked sheep; ordinary paddock sheep generally remain unaffected.

A Suspected Plant.

M.I. (Rockhampton)—

The specimen represents *Terminalia porphyrocarpa*. This plant as far as we know has not come under suspicion as a poisonous plant before, but an allied species known as yellowwood, namely *Terminalia oblongata*, which is very common in the Emerald district, has been proved by feeding tests to be harmful to sheep. Sheep fed on this species are said to become very poor in condition and to take fits, the symptoms being that the sheep drops in its tracks as though stunned, and lies trembling and rigid with extensor muscles of the neck and limbs strongly contracted. The sheep sometimes lies quite prone and sometimes props itself up and sways its head from side to side. The attack lasts from ten to forty seconds and the recovery is quick. The sheep struggles to its feet and stands for a few seconds swaying unsteadily, and then runs on to join the mob. The opinion is that when death resulted it was caused more by the indigestibility of the leaves than by any toxic character which produced the nervous disorder referred to.

Plants Suitable for the Upper Burnett.

S.G. (Mulgeldie)—

Following is a list of trees which should be worth while trying in your locality. The selection is confined to trees procurable through the ordinary nursery channels. The Botanic Gardens, Brisbane, are now under the control of the Brisbane City Council, and this Department has no young plants for distribution.

Celtis sinensis, Chinese celtis. This tree does remarkably well on the Darling Downs and is now being planted more or less extensively in the Burnett district. This tree is naturalised along the river at Gayndah, and you should be able to obtain seed from there. Seedlings often come up in such places under the parent trees. The leaves are good fodder for stock.

Bottle Tree, *Sterculia rupestris.*

Kurrajong, *Sterculia diversifolia.*

White Cedar, *Melia dubia.*

Camphor Laurel.

Figs.—Most of the varieties should do, particularly the Moreton Bay fig, or, preferably, the small-leaved Moreton Bay fig. The weeping fig is a fine tree, but if frosts are severe it may be badly cut back in winter.

Phytolacca (bellasombra). We notice you have tried this, but say it has not done too well. This is hard to understand, for in localities like yours this tree generally makes very rapid growth.

Silky Oak.

Coral Tree (*Erythrina*). Several varieties are in cultivation in Queensland.

A "Wild Lucerne."

T.C. (Chinchilla)—

The specimen represents *Psoralea patens*, a leguminous plant sometimes called wild lucerne, a vernacular, however, rather loosely applied in Queensland. Various species of *Psoralea* are very common in Queensland pastures, and are not known to possess any poisonous or harmful properties. Some are looked on as excellent fodder.

Wild Lettuce.

J.R. (Yeerongpilly)—

Your specimen represents a species of wild lettuce (*Lactuca*), probably *Lactuca scariola*, the prickly lettuce. The wild lettuces are sometimes regarded as poisonous to stock, but to what extent they are actually poisonous it is hard to say. Normally speaking, they are never eaten in sufficient quantities to cause trouble. In large quantities they are said to produce intoxication similar to that caused by poppy heads.

Two Common Herbs.

I.W.S. (Columboola)—

(1) *Euphorbia Drummondii*, caustic creeper, a very common herb in Western Queensland. It is reputedly poisonous to sheep, the symptoms given by experienced sheepmen being that the head and neck of affected animals swell very considerably. If the swelling is pierced an amber-coloured fluid exudes and the life of the sheep may be saved.

In New South Wales, where the plant also grows, a prussic-acid-yielding glucoside has been isolated from it, but the symptoms, as given by experienced sheepmen in Queensland, are certainly not those of prussic acid poisoning, and all tests with the Queensland plant so far have yielded negative or doubtful results. So far as we have observed, ordinary paddock or resting sheep are not affected by the plant, and commonly eat it freely without any ill effects following. Most of the trouble occurs with sheep that have been freshly untrucked, or are travelling, and have been allowed to eat large quantities of the plant.

(2) *Phyllanthus maderaspatanus*, a very common herb in Western Queensland, of which we have no particular knowledge as to its properties. It is probably eaten along with other herbage, but of its value or otherwise we are not very certain. Although it is a very common plant, we have not heard a local name for it.

General Notes

Staff Changes and Appointments.

Mr. J. W. Moy, Inspector of Stock, Toowoomba, has been appointed also an inspector under the Brands Acts.

Mr. C. W. Winders, B.Sc. Agr., Assistant (Agronomy), Department of Agriculture and Stock, has been appointed Assistant Agrostologist, Department of Agriculture and Stock.

Mr. A. R. Brimblecombe, Assistant to Entomologists, has been appointed Assistant Entomologist, Department of Agriculture and Stock.

Mr. C. G. Hughes, B.Sc. Agr., Assistant to Pathologist, Bureau of Sugar Experiment Stations, has been appointed Assistant Pathologist, Bureau of Sugar Experiment Stations.

Mr. L. Wood, Field Assistant, Department of Agriculture and Stock, Toowoomba, has been transferred to Brisbane.

Mr. R. J. Roache, Land Agent, Goondiwindi, has been appointed also an acting inspector of stock.

Mr. Percy Booth, "Yarrabine," Brooweena, has been appointed an hororary ranger under the Animals and Birds Acts.

Mr. A. M. Richardson, Inspector, Diseases in Plants Acts, will be transferred from Stanthorpe to Toowoomba.

Messrs. D. H. G. McIntosh (Tansey, via Goomeri), and H. Irving (Brandon), have been appointed Honorary Rangers under the Animals and Birds Acts.

Commodity Boards.

Regulations have been issued under "*The Primary Producers' Organisation and Marketing Acts,* 1926 *to* 1935," "*The Fruit Marketing Organisation Acts,* 1923 *to* 1934," "*The Dairy Products Stabilisation Acts,* 1933 *to* 1936," and "*The Wheat Pool Acts,* 1920 *to* 1930," prescribing the form of receipts and money forms issued in connection with the Council of Agriculture and commodity boards, the Committee of Direction of Fruit Marketing and other bodies, the Dairy Products Stabilisation Board, and the Wheat Board.

Animals and Birds Sanctuary.

Rita Island and the foreshores of the Burdekin River, and Ana Branch, near Ayr, have been declared a sanctuary under the Animals and Birds Acts.

Wandoan Tick Infested Area.

An Order in Council has been issued under the Diseases in Stock Acts declaring an area in the vicinity of Wandoan to be an infested area for the purposes of the Acts. For some years past, this particular country, which extends roughly from Wandoan to Clifford Holding, has been practically free from ticks, and stockowners in the area attempted to keep their stock tick-free. It is understood that the area is now thoroughly fenced, and by declaring it to be an effected area, stockowners will be protected as cattle will not be allowed to enter the infected area until they have been dipped at least twice and found free from ticks. By making this particular section an infected area, it will be an additional safeguard to the clean country on the Downs south of the Main Range.

Atherton Tableland Maize Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, extending the boundaries of the present district in North Queensland in which maize has been declared to be a commodity, namely, the Petty Sessions Districts of Atherton, Herberton, and Chillagoe (as defined at the time of the issue of the Order in Council constituting the Atherton Tableland Maize Board —31st August, 1923) to include all that locality which is contiguous to and is distant not more than fifty miles from a boundary of the said Petty Sessions Districts, and the Atherton Tableland Maize Board is extended to include the growers of maize in this additional locality.

Rural Topics

Entire Corn Cob as Stock Food.

The maize cob core has a very low feed value, and is digested with difficulty by animals, owing to its rubber-like consistency. In fact, if the cob core is not finely ground, animals will refuse to eat it, and if means for the grinding of the core are not available the feeding of the cob core with the corn grain is not advisable.

The grinding of the cob core requires considerable power and, therefore, cost of grinding has to be taken into consideration. The digestible crude protein content of the corn cob core is about 0.4 per cent., whereas the quantity of digestible crude protein in the corn grain ranges from 6 to 8 per cent. When the whole cob (core and grain) is ground to form what is called corn and cob meal the digestible crude protein of this meal will be considerably lower than that of the corn grain; the corn and cob meal may contain from 3.75 to 6 per cent. digestible protein. This variation in the digestible crude protein of the corn and cob meal is due to the fact that in different varieties of maize the proportion of core to grain ranges from 20 to 40 per cent.

In connection with the foregoing, it is considered that if there is a shortage of cheap roughage the grinding of the core of the cob with the grain will be of advantage; but when there is an abundance of roughage (hay, grass roughage, &c.) and an addition of concentrates (maize, &c.) is required to make a balanced ration with such roughage, it is then inadvisable to grind the core of the cob with the grain.—E. H. GURNEY, Agricultural Chemist.

Brigalow Foliage as Fodder.

Brigalow foliage, other than young shoots, has never been regarded as of value for stock in times of shortage owing to its unpalatability. There is, however, a variety which has not been separated botanically and which is not only acceptable to stock, but suggests, on analysis, a fodder value superior to that of mulga. This variety differs from the ordinary brigalow in leaf characteristics only. Its leaves are narrower and longer, and light green rather than silvery in colour. It occurs here and there in pure brigalow stands, as well as when the brigalow is interspersed with belah, but is thought to be more common in stands of less density where eucalypts also occur.

A sample for analysis was obtained at Chinchilla, close to the Condamine River. The analysis of mulga foliage is given for comparison, both being of water-free material:—

	Narrow-leaved Brigalow.	Mulga.
	Per cent.	Per cent.
Protein	13.9	11.1
Carbohydrates	54.6	55.9
Fat	2.5	3.2
Fibre	24.1	25.4
Ash	4.9	4.4

N. A. R. POLLOCK, Senior Instructor in Agriculture.

Essentials in Dairy Farm Lay Out.

There are two necessary adjuncts to a dairy farm which are often looked for in vain, namely, a crush and an isolation paddock.

A crush is necessary for the handling of bulls and young stock, but only a few farms are equipped with one.

An isolation paddock is a most necessary feature, but is conspicuous by its absence on nearly every dairy farm.

How many diseases could be checked if a farmer had a good isolation paddock in which he could place and watch a suspected animal, without any danger of the animal coming into contact with the rest of the herd?—S. E. PEGG, Inspector of Dairies.

Giant Setaria—An Attractive Crop.

The attention of farmers is once more called to the fact that certain crops offer attractive possibilities, and can be raised rapidly and at little cost, coincident with a change to normal seasonal conditions. At present *Setaria italica*, or so-called panicum seed, and preferably the giant variety, is proving an attractive crop for farmers who have land already prepared for sowing. The present price, *e.g.*, from £22 to £25 per ton, is very attractive, but naturally will recede as harvesting operations commence.

This is a crop which can be sown, with safety, up to the middle of January and probably even later, where suitable conditions obtain. The requirements of the Commonwealth, it is understood, for this class of grain are in the vicinity of 2,500 tons per annum.—A. E. GIBSON, Director of Agriculture.

Cream Supplies during Summer.

During the summer months when extreme heat conditions are common the necessity should be stressed for frequent and early deliveries of cream supplies to butter factories. Daily delivery of cream to the factories is an ideal difficult to attain in certain areas, but nothing less than four times a week delivery should be the rule from October to March, inclusive.

The practice of holding up supplies and delaying the cream carrier for the purpose of making certain that that morning's cream goes with the supply of cream obtained previously, should be discouraged. More harm than good is sometimes done to the cream supply through the practice of mixing the newly produced warm cream with the older and cooler cream. This practice is not infrequently the cause of cream being graded down on delivery at the factory platform.

Dairymen would be well advised to have their cream ready for the cream carrier on each morning of delivery. Should the morning's cream not be cooled down and ready on time, that particular cream should be held back for the next delivery, and, if this is done, better results will be obtained on arrival at the factory.

It has been reported that a number of dairymen make a practice of holding up the cream carrier for the purpose abovementioned, and even were this not detrimental to their own cream supply it is a selfish attitude to take up, in so far as neighbouring dairymen are concerned who desire their cream to arrive at the factory as early as possible.

With the advent of summer, the attention of all dairymen is directed to the necessity of supplying a cream with a butterfat content of not less than 38 per cent.

A sound slogan for all cream suppliers during the summer is: "Frequent and early delivery and test around forty."—A. HASSACK, Inspector of Dairies.

Sugar-Cane Varieties for Southern Queensland.

Those growers who have not yet experienced the benefits from growing the new gum-resistant canes, which have recently become so popular in Southern Queensland, are urged to include some in their present planting. The results from all trials harvested to date indicate that Co. 290 will far outyield all other varieties on practically all types of soil. It generally gives a fair c.c.s. value, while at times very good returns are reported. On damp alluvial lands it tends to maintain continuous growth, and with an "open" winter, heavy cane tonnages with low c.c.s. might result. Such conditions constitute but a small proportion of the lands on which the variety could be planted.

For all-round performance, P.O.J. 2878 is strongly to be recommended. For vigour of growth and drought resistance, it definitely excels, and as a standard cane it has no equal. This is a most important feature, as it enables the Southern grower, on frost-free areas, to revert to the "two-year cropping" methods, which were so popular before gumming disease took its toll, and which enable the grower to effect such a substantial lowering of costs of production. In these times, when excessively large crops demand that a proportion of the cane be stood over, no cane responds so satisfactorily in its second year of growth as a ratoon crop of this variety.

P.O.J. 2725 is a cane which has shown remarkable yields where moisture conditions are suitable, and it is definitely a valuable cane for irrigated land. Near the coast, it exhibits an unfortunate tendency to arrow early, which is a detriment if the farmer is obliged to standover the crop.—A. F. BELL, Bureau of Sugar Experiment Stations.

Orchard Notes

MARCH.

THE COASTAL DISTRICTS.

If the weather is favourable, all orchards, plantations, and vineyards should be cleaned up, and the ground brought into a good state of tilth so as to enable it to retain the necessary moisture for the proper development of trees or plants. As the wet season is frequently followed by dry autumn weather, this attention is important.

Banana plantations must be kept free from weeds, and suckering must be rigorously carried out, as there is no greater cause of injury to a banana plantation than neglect to cultivate. Good strong suckers will give good bunches of good fruit, whereas a lot of weedy overcrowded suckers will only give small bunches of undersized fruit that is hard to dispose of, even at a low price.

Cooler weather may tend to improve the carrying qualities of the fruit, but care must still be taken to see that it is not allowed to become over-developed before it is packed, otherwise it may arrive at its destination in an over-ripe and consequently unsaleable condition. The greatest care should be taken in grading and packing fruit. Only one size of fruit of even quality must be packed. Smaller or inferior fruit must never be packed with good large fruit, but must always be packed separately as required by regulation.

During recent weeks there has been a marked increase in the banana thrips population in those districts in which this pest is well established. Growers who consider it necessary to deal with banana thrips are advised that so far nicotine dusts applied at weekly intervals have given the most promising results. The dusts may be applied by means of an inexpensive hand dust gun, or by a rotary duster to which a special flexible outlet pipe has been fitted.

The marketing of the main crop of pineapples, both for canning and the fresh fruit trade, will be completed in the course of the month, and as soon as the fruit is disposed of plantations, which are apt to become somewhat dirty during the gathering of the crop, must be cleaned up. All weeds must be destroyed, and if blady grass has got hold anywhere it must be eradicated, even though a number of pineapple plants have to be sacrificed, for once a plantation becomes infested with this weed it takes possession and soon kills the crop. In addition to destroying all weed growth, the land should be well worked and brought into a state of thorough tilth.

In the Central and Northern districts, early varieties of the main crop of citrus fruits will ripen towards the end of the month. They will not be fully coloured, but they can be marketed as soon as they have developed sufficient sugar to be palatable; they should not be gathered whilst still sour and green.

As blue mould is likely to cause heavy loss in coastal citrus, especially in long distance consignments, special precautions should be taken for minimising this loss. It must be remembered that the blue mould fungus will only attack bruised or wounded fruit. Hence it is necessary to be careful that no injuries are given by the clippers or finger nails during picking. Fruit should be cut and not pulled. Long stalks which may injure other fruit must be avoided.

The fruit must be carefully handled and accurately packed so as to avoid bruising. Any injured fruit should be discarded. In order to reduce the number of fungus spores present in the plantation all waste fruit in the orchard or packing shed should be collected at frequent intervals and destroyed by fire or burying.

Fruit must be carefully graded for size and colour, and only one size of fruit of one quality should be packed in one case. The flat bushel-case (long packer) commonly used for citrus fruits does not lend itself to up-to-date methods of grading and packing, and we have yet to find a better case than the American orange case. Failing this case, a bushel-case suggested by the New South Wales Department of Agriculture is the most suitable for citrus fruits, and were it adopted it would be a simple matter to standardise the grades of our citrus fruit, as has been done in respect to apples packed in the standard bushel-case used generally for apples throughout the Commonwealth. The inside measurements of the case suggested are 18 in. long, 11¾ in. wide, and 10½ in. deep. This case has a capacity of 2,200 cubic inches, but is not included in the schedule of the regulations under "*The Fruit Cases Acts*, 1912-1922." The half-bushel case, No. 6 of the Schedule above referred to, is

10 in. by 11¾ in. by 5¼ in. inside measurements with a capacity of 1,100 cubic inches. The case should be suitable for oranges and the half-case for mandarins. No matter which case is used, the fruit must be sweated for seven days before it is sent to the Southern markets, in order to determine what fruit has been attacked by fruit fly, and also to enable bruised or injured fruit liable to blue mould to be removed prior to despatch.

Growers are reminded that the control of the bronze orange bug is best achieved by spraying with the resin-caustic soda-fish oil mixture normally either late in March or early in April. Applied at this time of the year the spray can give a mortality of 98 per cent. of the bronze bugs, which are then present solely in the very young stages. This spray is also very effective against several of the important scale insects infesting citrus.

Red scale is a pest to which citrus growers will shortly have to give attention, it being considered that control is best established from the middle of March to early in April. Fumigation with hydrocyanic acid gas is most effective against red scale, but success may also be achieved with white oils or with the resin-caustic soda-fish oil mixture evolved for the control of the bronze orange bug. Red scale, of course, is pre-eminently a pest of the hotter drier citrus districts.

Strawberry planting may be continued during the month, and the advice given in last month's notes still holds good. Remember that no crop gives a better return for extra care and attention in the preparation of the land and for generous manuring than the strawberry.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE advice given in these notes for the last few months regarding the handling, grading, and packing of fruit should still be followed carefully. The later varieties of apples and other fruits are much better keepers than earlier-ripening sorts, and as they can be sent to comparatively distant markets, the necessity for very careful grading and packing is, if anything, greater than it is in the case of fruit sent to nearby markets for immediate consumption. Instruction in the most up-to-date methods of grading and packing fruit has been published by the Department, which advice and instruction should enable the growers in that district to market their produce in a much more attractive form.

The same care is necessary in the packing of grapes. Those who are not expert cannot do better than follow the methods of the most successful packers.

As soon as the crop of fruit has been disposed of, the orchard should be cleaned up, and the land worked. If this is done, many of the fruit-fly pupæ that are in the soil will be exposed to destruction in large numbers by birds, or by ants and other insects. If the ground is not worked and is covered with weed growth, there is little chance of the pupæ being destroyed.

Where citrus trees show signs of the want of water, they should be given an irrigation during the month, but if the fruit is well developed and approaching the ripening stage, it is not advisable to do more than keep the ground in a thorough state of tilth, unless the trees are suffering badly, as too much moisture is apt to produce a large, puffy fruit of poor quality and a bad shipper. A light watering is therefore all that is necessary in this case, especially if the orchard has been given the attention recommended in these notes from month to month.

Farm Notes

MARCH.

LAND on which it is intended to plant winter cereals should be in a forward stage of preparation. Sowings of lucerne may be made at the latter end of the month on land which is free from weed growth and has been previously well prepared.

The March-April planting season has much in its favour, not the least of which is that weeds will not make such vigorous growth during the succeeding few months, and, as a consequence, the young lucerne plants will have an excellent opportunity of becoming well established.

Seed wheat should be treated with copper carbonate for the control of bunt. For oats and barley seed the use of formalin or a reliable mercury dust is advisable.

Potato crops should be showing above ground, and should be well cultivated to keep the surface soil in good condition; also to destroy any weed growth.

In districts where the potato crop is subject to Irish blight it is advisable to spray the plants for the control of this disease. Bordeaux mixture of 4.4.40 strength should be applied at least three times at intervals of ten days to a fortnight, commencing when the plants are about six weeks old.

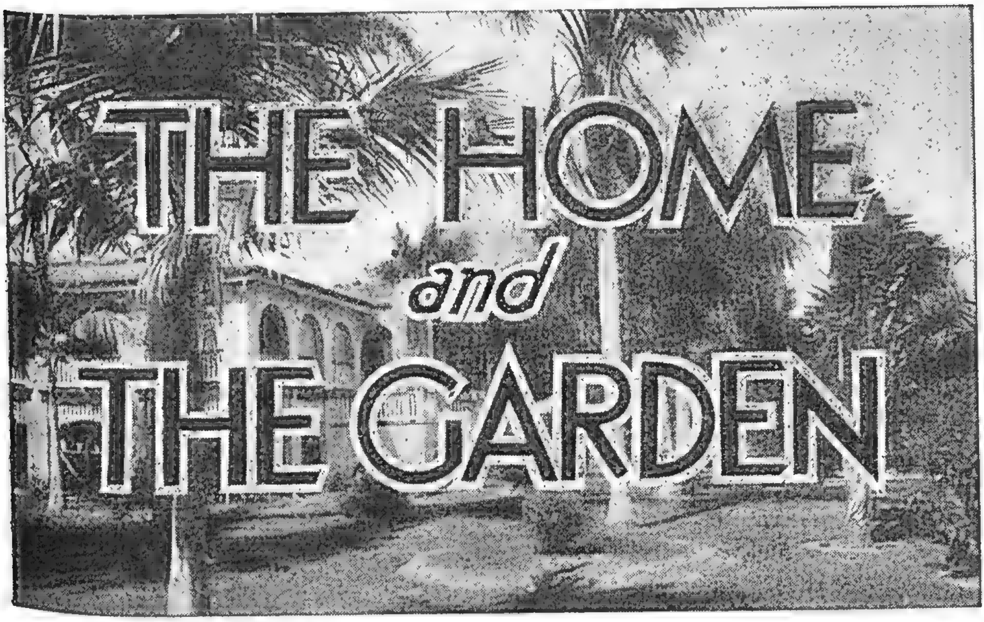
Maize crops which have fully ripened should be picked as soon as possible and the ears stored in well-ventilated corn cribs, or barns. Selected grain which is intended for future seed supplies should be well fumigated for thirty-six hours and subsequently aerated and stored in airtight containers. The germination of the maize is not normally affected by this treatment if dry and mature when treated.

The following crops for pig feed may be sown:—Mangel, sugar beet, turnips and swedes, rape, field cabbage, and carrots. Owing to the small nature of the seeds, the land should be worked up to a fine tilth before planting, and should contain ample moisture in the surface soil to ensure a good germination. Particular attention should be paid to all weed growth during the early stages of growth of the young plants.

As regular supplies of succulent fodder are essentials of success in dairying operations, consideration should be given to a definite cropping system throughout the autumn and winter, and to the preparation and manuring of the land well in advance of the periods allotted for the successive sowings of seed.

The early-planted cotton crops should be now ready for picking. This should not be done while there is any moisture on the bolls, either from showers or dew. Packed cotton showing any trace of dampness should be exposed to the sun for a few hours on tarpaulins, bags, or hessian sheets, before storage in bulk or bagging or baling for ginning. Sowings of prairie grass and *Phalaris bulbosa* (Toowoomba canary grass) may be made this month. Both are excellent winter grasses. Prairie grass does particularly well on scrub soil.

Dairymen who have maize crops which show no promise of returning satisfactory yields of grain would be well advised to convert these into ensilage to be used for winter feed. This, especially when fed in conjunction with lucerne or cowpea, is a valuable fodder. Where crops of Soudan grass, sorghum, white panicum, Japanese millet, and liberty millet have reached a suitable stage for converting into ensilage, it will be found that this method of conserving them has much to recommend it. Stacking with a framework of poles, and well weighting the fodder, is necessary for best results. All stacks should be protected from rain by topping off with a good covering of bush hay built to a full eave and held in position by means of weighted wires.



OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

MEAN WHAT YOU SAY.

IT is most important that parents should mean what they say in dealing with their children, and that the children should know this. It is worse than useless to allow a child to do something one day and punish him for doing the very same thing next day. How is he to know what to expect? Last week mother did not allow him to play out on the street, but one day the week before she did. Naturally, being a clever, reasonable child, he thinks he will risk it again. Mother may not punish him.

Bribes and threats are wrong means of teaching a child to obey. If you tell a child that you will give him something nice if he does what you ask you are bribing him, and before long you will find he will do nothing unless he gets something out of it.

Very few of the parents who threaten their children mean what they say. A mother may say to her naughty child: "I will ask the policeman to come and take you to gaol." She knows it is not true. At first her threat frightens the child; then he learns that it is not true, and before long he takes no notice. Threats may turn him into a coward; every mother who wants her child to be brave should avoid them. On the other hand, if the threats are never carried out the child may grow indifferent. It is best never to threaten.

Children do not obey people whom they cannot trust, and parents who break promises to their children cannot expect to be trusted or obeyed by their children.

Speak Quietly.

Here is another point. When your child is not obedient do you become angry and raise your voice? That excites the child, and some children like such excitement very much. They will even do things they know are naughty just for the sake of seeing mother lose her temper. If parents can manage not to get angry they will find it much easier to teach their children to be obedient. Loud talking is a strain to listen to, and is bad both for children and for grown-ups. It makes the home noisy; noise makes everyone in the home nervous and irritable. Parents who always speak quietly find that their children will listen to them more willingly.

Be Reasonable.

A toddler's doings, which seem so trivial to many grown-ups, are really very important indeed to him; and the things that grown-ups think so very important mean nothing at all to him. He does not think, for example, it is important to give up his play and come to dinner as soon as he is called.

It is a good plan to allow the child a few minutes to finish what he is doing before you expect him to obey a command. Let him have five minutes' grace before mealtime and before bedtime, for instance. There are some things little children really cannot do, and yet they are often asked to do them—for instance, to sit still for a long time, to keep from making a noise for a long time. It is not fair to expect little children to do these things, which adults can, of course, do quite easily. The child's muscles are too busy growing to allow him to sit still for a long time. They need constant exercise—by wriggling and other means which sometimes annoy tired mothers—in order to grow. Only an adult, whose muscles have reached their final stage of growth, can discipline his muscles so that he can sit still for a long time. And making a noise is a part of the business of growing. The toddler's chattering and shouting are just as important to healthy growth as is the lusty crying of the healthy infant.

It is not really hard to teach a child to obey the first time you speak if you always speak quietly, never angrily; if you let the child find by experience that everything is pleasant when he takes notice quickly but not so pleasant if he does not obey. When the little child is good and obedient it is right for mother to show that she is pleased to allow some little treat.

Teach Children to Think for Themselves.

If people are to be happy when they grow up they must have learned to obey certain rules when they were children; but they must have learned to think for themselves. Children must be taught to think for themselves what is right for them to do. There are children who never do anything by themselves. They never think for themselves. They have to wait until someone tells them what to do. When they grow up they are very unhappy because they cannot be independent.

Let us teach our children to think for themselves, encourage them when they plan to do things without help, when they attempt to fasten their own shoes, to put on their own socks, to do up their buttons, to wash their faces. They may seem to be getting on very slowly. It takes time to let them make the effort to help themselves, but try to be patient while they accomplish what they are trying to do. Praise them for trying to help themselves. It will be all the better for them if they learn to be independent, and in the long run all the better for mother.

IN THE FARM KITCHEN.

PINEAPPLES FOR SUMMER DISHES.

Following are some recipes which reveal pineapple in a new light:—

Pineapple Meringue.

Take 1 pineapple, ¼ lb. sugar, ½ pint water, 4 oz. crystallised fruits, 4 egg-whites, ½ lb. castor sugar, 6 meringues, 1 tablespoonful sherry, ¼ pint whipped cream, cochineal.

Boil the founr ounces of sugar and the water together till thick syrup, mince crystallised fruit very finely, pour syrup on to fruit, let it get cold, peel pineapple, core the centre, add sherry to syrup, fill pineapple with mixture, putting fruit in centre and syrup last of all. Whip egg-whites very stiffly, add castor sugar, put in a forcing bag with rose pipe, and cover the pineapple with it, stand on a baking sheet in oven until meringue is quite set, then take out and stand on a glass dish, pour remainder of syrup on the fruit in the centre, place in the hole the pineapple-top, neatly trimmed, fill meringues with whipped cream, coloured a delicate pink with a little cochineal, and pour the remainder of the cream round the base of the pineapple and arrange meringues on top.

Pineapple Sponge.

Take half grated pineapple, ½ oz. gelatine, 2 egg-whites, 1 lemon, 2 oz. sugar, ½ pint custard, 1 tablespoonful sherry, crystallised fruits.

Soak the gelatine in about two tablespoonfuls water for one hour, dissolve over hot water with the juice of a lemon and sugar, add the pineapple, and stir all over the gas until thoroughly mixed. Add the sherry, and pour into a basin to slightly set, beat the egg-whites stiffly, and add to the fruit mixture, and whisk till firm. Stand on ice for a little while, then heap on a glass dish; pour custard round and garnish with crystallised fruits.

Pineapple Meringue Pie.

Take 1 ripe pineapple, ½ cupful sugar, 1 cupful thin cream, 3 eggs, pinch salt, 3 tablespoonfuls castor sugar, pastry.

Pare and remove the " eyes " from the pineapple, grate finely. Add the sugar, cream, egg-yolks beaten slightly, and a pinch of salt. Mix all well together and bake in a pie pan, lined with a good pastry, until firm in the centre. Whip the egg-whites very stiffly, and add the castor sugar and mix well. Spread the meringue on pie and return to oven to brown.

Pineapple Tartlets.

Take 1 small pineapple, 2 oz. castor sugar, ½ pint cold water, 3 oz. blanched almonds, 6 oz. shortcrust.

Pare and remove the eyes of the pineapple, then slice and core. Place in a saucepan. Add the sugar and water. Stir till boiling, then simmer for fifteen minutes. Drain, then boil syrup till thick. Cool. Line tartlet tins with shortcrust. Prick with a fork and bake in a hot oven for a quarter of an hour. Place a pineapple ring in each case. Cover with syrup. Decorate with almonds.

Pineapple Tarts.

Take 1 small pineapple, two-thirds of a cupful of sugar, juice ½ orange, ½ lemon, rind ½ orange, 1 egg-white, 1 tablespoonful castor sugar, pastry.

Pare and grate the pineapple, add the sugar, orange, lemon juice, and the grated orange rind. Cook slowly until mixture thickens. Prepare some small pastry shells, made in small patty-pans. Turn mixture into the pastry shells. Make a meringue with the egg-white and castor sugar, and pile in a pyramid on top of each. Return to the oven to brown delicately.

Pineapple Dainty.

Take 1 tin sliced pineapple, good ½ oz. gelatine, ½ cupful hot water, sugar to taste, some glace cherries, carmine.

Dissolve the gelatine in the hot water. Drain syrup from pineapple; add dissolved gelatine to syrup and water to make one pint of liquid. Add sugar to taste if required. Run a little of the jelly into the bottom of a plain mould, and

when set place a slice of pineapple with a cherry in the centre. Pour over a little more jelly. When this is set, mask the sides of the mould with jelly and decorate with slices of pineapple and cherries. Chop the remainder of the pineapple and add to the jelly; add a few drops of carmine. Whisk well until thick and on the point of setting, then fill the prepared mould till set. Turn out on to a glass dish and serve with whipped cream if liked.

Pineapple Medley.

Take 1 large tin pineapple (sliced), 2 bananas, 1½ oz. almonds, 2 oz. glace cherries, 3 dessertspoonfuls orange juice, ½ oz. gelatine.

Drain the pineapple and put it through the mincer, keeping back three slices for decoration. Blanch and chop the almonds, cut up the cherries, and peel the bananas. Cut them into small dice. Dissolve the gelatine in a saucepan with half a gill of the pineapple juice, warmed, then strain it into the remainder of the juice and add the orange juice. Stir in the minced pineapple and other prepared fruits and almonds, then turn them into a mould which has been rinsed out with cold water. When quite set, unmould the medley and decorate it with whipped cream and the remainder of the pineapple.

Pineapple Lemonade.

Take 1 pineapple, 1 lb. castor sugar, 5 lemons, 3 pints water.

Carefully peel and grate the pineapple. Pour over it the strained juice of the lemons. Boil sugar and one pint of the water for ten minutes, stir syrup into the fruit juices, add one quart of cold water, then strain through fine muslin. Serve in glasses quarter-filled with cracked ice, adding a cherry to each glass.

Pineapple and Melon Jam.

Take 2 lb. pineapple, 4 lb. of the firm part of a sugarmelon, 3 lb. sugar.

Peel and cut into cubes the firm part of the melon. Peel and grate the pineapple with a fork. Put the fruit into a preserving pan and boil for three hours with half of the sugar, add the remainder of the sugar, and boil for one hour longer or until it jells.

Pineapple and Tomato Jam.

Take 3 large pineapples, 7½ lb. tomatoes, sugar.

Peel the pineapples, remove the "eyes" and chop up finely. Put the tomatoes into boiling water, so that the skins come off easily. Put the pineapple and tomatoes into a preserving pan and stew gently till the pineapple is soft. Then add three-quarters of a pound of sugar to each pound of mixture and boil till it is done. Let it cool a little before putting into the jars, which must be warm and perfectly dry.

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RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF DECEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1936 AND 1935, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Dec.	No. of Years' Records.	Dec., 1936.	Dec., 1935.
North Coast.	In.		In.	In.
Atherton	7·22	35	11·34	1·21
Cairns	8·74	54	8·95	·62
Cardwell	8·21	64	12·22	·53
Cooktown	6·62	60	7·53	·12
Herberton	5·72	50	7·57	2·58
Ingham	6·92	44	12·98	1·04
Innisfail	11·79	55	16·77	1·36
Mossman Mill	10·31	23	15·04	·70
Townsville	5·49	65	7·03	·50
Central Coast.				
Ayr	3·95	49	8·16	·28
Bowen	4·38	65	10·29	·37
Charters Towers	2·28	54	3·56	·134
Mackay	7·09	65	10·25	·148
Proserpine	7·78	33	8·87	·312
St. Lawrence	4·77	65	3·93	·169
South Coast.				
Biggenden	4·71	37	5·19	4·58
Bundaberg	5·15	53	3·01	9·32
Brisbane	4·94	84	1·80	3·63
Caboolture	5·31	49	1·87	4·47
Childers	5·70	41	5·12	6·93
Crohamhurst	7·32	43	2·27	8·30
Esk	4·75	49	3·43	4·60
Gayndah	4·22	65	2·96	6·19
Gympie	6·08	66	3·76	6·57
Kilkivan	4·61	57	2·25	6·45
Maryborough	5·12	65	3·93	5·51
Nambour	6·93	40	1·38	4·97
Nanango	3·84	54	2·93	2·91
Rockhampton	4·85	65	2·64	5·85
Woodford	5·64	49	2·18	4·88
Central Highlands.	In.		In.	In.
Clermont	3·84	65	3·08	1·73
Gindie	2·82	37	..	2·97
Springsure	3·26	67	2·20	3·23
Darling Downs.				
Dalby	3·34	66	5·10	5·01
Emu Vale	3·51	40	3·35	2·40
Hermitage	2·95	30	..	3·18
Jimbour	3·28	48	5·56	2·92
Miles	3·16	51	3·38	2·56
Stanthorpe	3·58	63	5·59	3·34
Toowoomba	4·43	64	5·91	2·66
Warwick	3·42	71	5·72	3·55
Maranoa.				
Roma	2·54	62	4·96	2·08
State Farms, &c.				
Bungeworgorai	3·01	22	6·10	·95
Gatton College	3·75	37	8·69	5·29
Kairi	6·30	22	..	..
Mackay Sugar Experiment Station	8·07	39	10·55	1·66

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—DECEMBER, 1936.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Means at 9 a.m.	Shade Temperature. Means.		Shade Temperature. Extremes.				Rainfall.	
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·81	85	77	89	5, 21, 23, 24, 25, 26, 27, 29, 30, 31	73	3, 4	753	16
Herberton	..	81	64	90	2	59	15	705	17
Rockhampton	29·90	88	71	95	3	66	2	264	10
Brisbane	29·95	85	68	95	23	64	5	180	8
Darling Downs.									
Dalby	29·91	88	64	100	2	54	5	510	13
Stanthorpe	..	81	58	95	1	43	5	559	14
Toowoomba	..	83	61	96	2	49	5	591	12
Mid-Interior.									
Georgetown	29·83	93	72	100	22, 23,	67	15	1116	18
Longreach	29·82	98	71	106	23	61	5	128	9
Mitchell	29·86	90	68	101	1, 2, 3, 21	54	5	343	15
Western.									
Burketown	29·80	94	76	100	24	65	5	703	11
Boulia	29·78	102	75	109	12, 23	60	5	64	3
Thargomindah	29·80	95	70	106	12	56	5	484	5

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	February, 1937.		March, 1937.		MOONRISE. Feb., 1937.	MOONRISE. Mar., 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·26	6·47	5·46	6·24	9·49	8·23
2	5·26	6·46	5·46	6·23	10·24	8·59
3	5·27	6·46	5·47	6·23	11·1	9·38
4	5·27	6·45	5·47	6·22	11·42	10·12
5	5·28	6·44	5·48	6 21	..	11·8
					a.m.	
6	5·29	6·44	5·48	6·21	12·27	11·59
						a.m.
7	5·29	6·43	5·49	6·20	1·15	..
8	5·30	6·42	5·49	6·19	2·11	12·54
9	5·31	6·42	5·50	6·18	3·8	1·53
10	5·31	6·41	5·50	6·16	4·10	2·52
11	5·32	6·40	5·51	6·15	5·10	3·54
12	5·33	6·39	5·51	6·14	6·12	4·55
13	5·33	6·39	5·52	6·12	7·14	5·58
14	5·34	6·38	5·52	6·11	8·14	7·1
15	5·35	6·37	5·53	6·10	9·18	8·8
16	5·35	6·37	5·54	6 8	10·21	9·15
17	5·36	6·36	5·54	6·7	11·32	10·22
					p.m.	
18	5 37	6·35	5·55	6·6	12·36	11·27
						p.m.
19	5·37	6·34	5·55	6·5	1·37	12·28
20	5·38	6·33	5·56	6·4	2·30	1·23
21	5·39	6·32	5 56	6·3	3·21	2·11
22	5·39	6·31	5·57	6·2	4·12	2·54
23	5·40	6·30	5·57	6·1	4·54	3·33
24	5·41	6·29	5·58	6·0	5·33	4·8
25	5·42	6·28	5·59	5·59	6·8	4·41
26	5·43	6·27	5·59	5·57	6·41	5·16
27	5·44	6·26	6·0	5·56	7·14	5·49
28	5·45	6·25	6·0	5·54	7.47	6·22
29			6·1	5 53		6·59
30			6·1	5·51		7·36
31			6·2	5·50		8·17

Phases of the Moon, Occultations, &c.

3 Feb.	☽ Last Quarter	10 4 p.m.
11 „	● New Moon	5 34 p.m.
18 „	☾ First Quarter	1 49 p.m.
25 „	○ Full Moon	5 43 p.m.

Apogee, 3rd February, at 10 p.m.

Perigee, 16th February, at 6 a.m.

The Moon will pass Jupiter on the 8th, Mercury on the 9th, and Saturn on the 13th, but in daylight and below the horizon.

Mercury rises at 3.39 a.m., 49 minutes before the Sun, on the 1st, and sets at 5.10 p.m., 1 hour 25 minutes before it; on the 14th it rises at 3.39 a.m., 1 hour 55 minutes before the Sun, and sets at 5.13 p.m., 1 hour 25 minutes before it.

Venus rises at 9.0 a.m., 3 hours 34 minutes after the Sun, on the 1st, and sets at 9.7 p.m., 2 hours 20 minutes after it; on the 14th it rises at 9.7 a.m., 3 hours 33 minutes after the Sun, and sets at 8.45 p.m., 2 hours 7 minutes after it.

Mars rises at 11.21 p.m. and sets at 12.30 p.m. on the 1st; on the 14th it rises at 10.49 p.m. and sets at 11.59 a.m.

Jupiter rises at 3.17 a.m. and sets at 5.2 p.m. on the 1st; on the 14th it rises at 2.38 a.m. and sets at 4.20 p.m.

Saturn rises at 8.21 a.m. and sets at 8.52 p.m. on the 1st; on the 14th it rises at 7.34 a.m. and sets at 8.38 p.m.

Although in this the shortest month of the year there are but few of the usual phenomena to record, and those not of great public interest, the wonderful display of the Northern constellations will compensate for the loss. Piloted across the sky by the most attractive little star group seen with the naked eye, the Pleiades, are the Hyades, with the red-glowing Aldebaran of Biblical fame, then Orion, in splendid attire, with two stars of first magnitude and five of the second, his belt inlaid "with patines of bright gold," and the short, gleaming sword. The Great Hunter is followed by Canis Major, with Sirius, flashing and scintillating in various colours, larger than any first magnitude star. Across in the south-east Canopus, in Argo, the second in rank among all stars, is most noticeable. Early in evening, when Venus, like a little Sun, lights up the western sky, the Southern Cross will be rising in the south-east, welcomed as warmly in the Southern Hemisphere as the Pleiades are in Northern lands.

5 Mar.	☽ Last Quarter	7 17 p.m.
13 „	● New Moon	5 32 a.m.
19 „	☾ First Quarter	9 46 p.m.
27 „	○ Full Moon	9 12 a.m.

Apogee, 3rd March, at 6.0 p.m.

Perigee, 15th March, at 1.0 p.m.

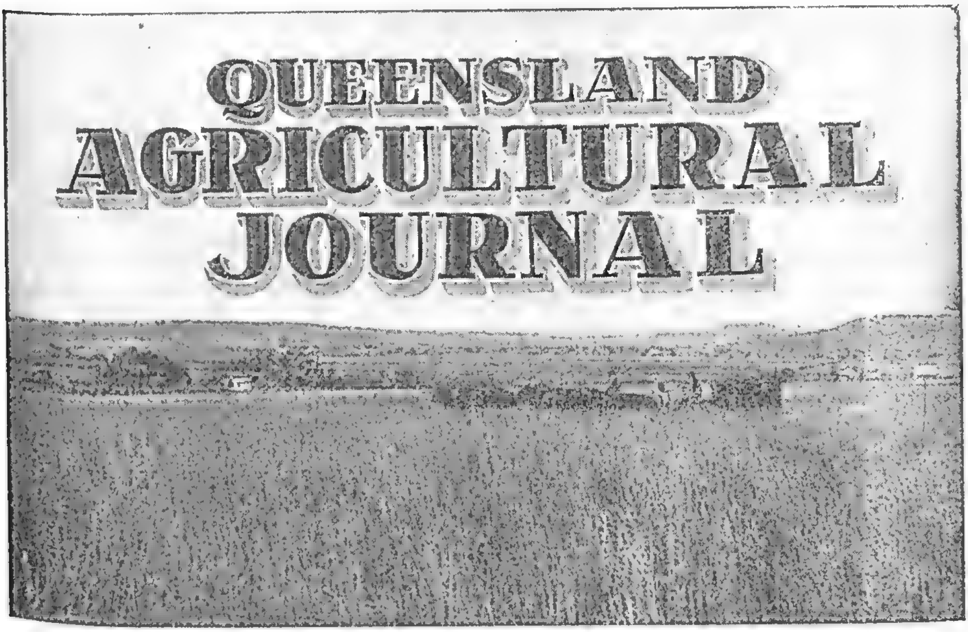
For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten** shillings, including postage.



VOL. XLVII. 1 MARCH, 1937. PART 3

Event and Comment

The Problem of Unemployed Youth.

REPRESENTATIVES of all the States were present at a recent conference in Melbourne on the employment of youth, and which was convened by the Commonwealth Government. The problem was discussed from all angles. The general consensus of opinion affirmed the acceptance of the duty which we of this generation have in respect of the boys and girls now entering the period of adolescence. In Australia, as in most other countries, many young people are approaching full maturity without knowing what it is to have had a real job in life. In fact, many have already arrived at manhood and womanhood without finding a settled place in the industrial life of the community. The Premier (Hon. W. Forgan Smith, LL.D.) represented Queensland at the conference. Discussing the business done, he made it clear that while a pronouncement on the proceedings would be premature the problem would be attacked in a new way.

In the course of a statement on the subject, the Premier said that at the present stage it was interesting to review what Queensland had done to provide employment for boys and girls. The depression had brought

with it so many problems that young people were left to fend for themselves, and consequently fared very badly. He added—

"It was not until 1935 that Queensland made a determined and united effort to solve juvenile unemployment, and our real progress began from the day in January, 1935, when, as a result of a conference, a Juvenile Employment Board was set up and a Juvenile Employment Bureau opened.

"The problem was looked at fairly and squarely, and it was decided that the best means of assisting children towards permanent employment was by directing them from school to work. The Department of Public Instruction was made the central point of activity, and the Juvenile Employment Bureau was set up to work in three sections:—

1.—Commercial Section: At the State Commercial High School and College.

2.—The Industrial Section: At the Apprenticeship Office.

3.—The Rural Section: At the Head Office of the Department of Public Instruction.

"It was appreciated that there was little value in waiting for employers to approach the Bureau, so the policy from the beginning was to seek employers in order to find the right boy or the right girl for the right job. Employers were afforded the services of the Bureau which saved them much time and trouble in interviewing and classifying applicants, and the worry and bother of selection passed to the skilled officers of the Juvenile Employment Bureau.

"There have been 6,072 boys and girls placed in employment through the Bureau during those two years of operation, and when the placements of the other Government activities are added, it is found that between 1st July, 1932, and 31st December, 1936, 16,856 boys and girls have been placed in jobs. That is a record of which Queensland has cause for pride.

"First steps were taken in Brisbane. Each year 5,500 boys and girls complete their full-time education and seek employment, and of that number the Bureau, during its first year of operation, placed 53 per cent. of Brisbane's output. This excellent result was obtained by energy and enthusiasm. Nearly 2,000 children were found positions by the Commercial Section, over 3,000 by the Industrial Section, and nearly 1,000 by the Rural Section. Trained children from the Commercial Section find more or less ready employment in the offices, shops, and factories, but it is in respect of the rural employment that the most difficulty is encountered."

The Claims of Agriculture.

CONTINUING, Mr. Forgan Smith remarked that it was well known that in Queensland there was an aversion on the part of many parents from employment of their boys in the country. He said:—

"Many parents prefer that their boy should remain out of work rather than that he should take a job on a farm; but such a view is a narrow one, when it is appreciated that the source of wealth is the land, and that the city is dependent on the country for its

prosperity. Agriculture is a science, not a form of drudgery. The farmer must be a man of knowledge and experience, who needs many qualities for success, and success in agriculture is as worthy as success in any other profession. But the public outlook has not been favourable.

"I pointed out in early announcements that 'it was definitely the Government's policy to encourage these boys to become future settlers with farms of their own.' In continuance of that policy we are training boys who will ultimately become successful farmers and good citizens of the State. Invaluable in that direction has been the assistance of the St. Lucia Farm School, the history of which is a particularly interesting one. Some five years ago the Minister for Agriculture outlined a project for the establishment of a farm training school at a place convenient to the city, and St. Lucia was the result.

"The idea behind the scheme was to give workless city boys an opportunity for training for a country career, to assist Australian youth to become good Australians. Since that date, 100 per cent. of the boys admitted to the school have been trained, employed on farms or proceeded to higher studies at the Agricultural College at Gatton, and 263 graduates of the school are now making their way in agriculture. But our attack upon youthful employment problem was not limited to that sector. Our apprenticeship scheme, which had long proved its worth, has been continued and increased, and since 1932 there have been 2,445 boys apprenticed in this State to skilled trades. Side by side with the work is the work of the Juvenile Employment Bureau. The Labour Bureau through its various offices in Queensland has been endeavouring to fill vacancies, and 1,708 boys and girls were placed through its agencies. The State Children's Department is another means of youthful employment, and 1,593 boys and girls have been placed by this Department.

"When the revival of employment of youth was instituted in 1935, the Government appreciated that it must give a lead to private enterprise, so Crown employment was stimulated, and as a result 1,305 young people have been placed in this way. One of the outstanding successes in Juvenile Employment has been the New Settlers' League, a body which works quietly and efficiently, placing boys in selected employment on farms, watching their progress, supervising their employment, and generally acting as father to 675 lads who have been found employment in this way since 1932.

"Prior to the Juvenile Employment Bureau operating, we had a Vocational Training Scheme which absorbed some 1,043 boys, and in addition through the Railway Department, the Forestry Department, the Police Department, the Rural Training Scheme, the Department of Labour and Industry, and the Riverview Training Farm Scheme, the total employment of boys and girls has been brought to 16,856, and now at this stage the Commonwealth proposes a scheme which is described as 'industrial repatriation' operating over two or three years, and provided the necessary grant is made available, the States will be enabled to multiply their efforts to achieve the aim which is to provide a job for every boy and girl in the community."

The Grasshopper Outbreak in Queensland. 1934-35.

J. A. WEDDELL, Entomologist.

INTRODUCTION.

QUEENSLAND as a State does not suffer so severely from grasshopper plagues as some other areas throughout the world. Numerous species are, of course, present in the State, but only one or two are capable of plague incidence. The far western districts normally carry a moderate grasshopper population, of little economic significance, and only when large swarms tend to invade and breed heavily in the more valuable near western areas, or, alternatively, when the numbers in the far western districts rise to extraordinary proportions, would the problem of the plague grasshopper arise. It is mainly with the first of these alternatives as illustrated by the grasshopper outbreak of 1934-35 that the present report is concerned.

SECTION I.

HISTORY OF GRASSHOPPER OUTBREAKS IN QUEENSLAND.

Recorded Plagues Prior to 1934.

It is recorded in the Proceedings of the Royal Society of Queensland, Vol. 1, 1884, pp. 59-60, that Mr. H. Tryon referred to a locust plague infesting sugar plantations in March, 1884, on the Lower Herbert, North Queensland, the species being mentioned as probably *Stenobothrus vittifrons*. Damage to the extent of £30,000 was alleged. Some three years earlier, grasshoppers had spread over the plain, of 150 square miles, bounded by the Herbert and Stone rivers and the coast.

Another early reference in Queensland to grasshopper plagues is contained in "Report on Insect and Fungus Pests, No. 1," Tryon, 1889, pp. 217-223. The insect is referred to as *Oedipoda* sp., but the descriptions given establish the species as *Chortoicetes terminifera* Walk. Life history, habits and control are also discussed. It is recorded that Toowoomba was visited during December, 1886, by quite a plague of grasshoppers, which did immense damage to pasture.

Other records of past grasshopper invasions in Queensland usually refer to the yellow-winged locust, *Locusta danica*, L., by which is possibly meant *Gastrimargus musicus* Fabr. The following brief summaries of the records of significant outbreaks are taken from the annual reports of Mr. H. Tryon, then Government Entomologist and Vegetable Pathologist:—

1902-03.—Pasturage: Grasshoppers, Darling Downs.

1907-08.—Pasturage: Grasshoppers (*Locusta danica*), Rockhampton.

1911-12.—Yellow-winged grasshoppers (*Locusta danica*), Mossman River, Cairns, Tolga, Townsville, Springsure, Clermont, Kamerunga, Central and Western districts. Swarms of young hoppers occurred in Central and Western districts, September, 1911. In February, 1912, several properties were still suffering severely over hundreds of square miles. A mite (*Podolipus* sp.) preyed upon the adults, and a small hymenopterous insect, *Scelio* (*Australis* Frog.) attacked the eggs.

1914-15.—Grasshopper (*Locusta danica* L.). Considerable damage in the Ayr district to sugar cane. Grasshoppers (*Locusta danica*), throughout a vast area in the Central district of which Springsure might

be regarded as the centre. The grasshopper parasite (*Podolipus* sp.—*Acarina*) was very numerous on adults in the Burdekin district in April, 1915.

1915-16.—Yellow-winged locust (*Locusta danica*), Townsville, Lower Burdekin, Herbert River—affecting grass, a brood hatching out during the middle of October; very destructive.

1916-17.—Grasshoppers, affecting pasturage, Toogoolawah district.

THE PLAGUE OF 1934-35.

The grasshopper outbreak in 1934 was unexpected, but surveys soon showed that pasture and crop destruction was bound to be extensive. In the more closely settled areas control operations were clearly necessary. This report summarises the observations made in Queensland and discusses the control programme that was put into operation.

Several officers took part in the investigations and control organisation. Associated with the writer in South Queensland at various times were Messrs. N. E. H. Caldwell, W. J. S. Sloan, and T. H. Strong; Mr. A. R. Brimblecombe investigated the outbreak at Wallumbilla; Mr. Sloan later reported an outbreak in the Callide Valley; Mr. J. H. Smith was responsible for the survey in North-western Queensland. The writer saw most of the phases of the outbreak in the southern portion of the State.

Species Concerned and Distribution.

The main species involved was the common plague grasshopper of Australia, *Chortoicetes terminifera* Walk., usually referred to in literature as "the wandering grasshopper," but better known in Southern Queensland as the "plague grasshopper." This species was widely distributed. Plate 73 illustrates the observed distribution of *C. terminifera* during 1934-35. Two species—*Gastrimargus musicus* and *Austacris proxima proxima* Walk.—were associated with *C. terminifera* in the North Queensland outbreak, but the lastmentioned species was even there the most important. A small species—*Phaulacridium gemini* Sjostedt (a brachypterous form)—attacked tobacco in the Texas distrct.

Species-locality records made during the currency of the attack are listed below:—

BRIEF SUMMARY OF SPECIES, DISTRIBUTION, AND IMPORTANCE OF GRASSHOPPERS IN QUEENSLAND, 1934-1935.

1. *Chortoicetes terminifera* Walk.—wandering or plague grasshopper.

Toowoomba	Occasional specimens collected.
Warwick, Oakey, Jondaryan, Wallumbilla, Tara, Roma, Mitchell, Taroom, Callide Valley	Infestations of relatively minor importance.
St. Helens, Irongate, Yarranlea, Millmerran, Kooroongarra, Leyburn, Inglewood, Yelarbon, Texas, Goondiwindi and surrounding districts.	The main area in which infestation was important, both locally and as a potential menace to other districts. Successive generations bred in the localities mentioned.
Far Western districts, including Cunnamulla, Eulo, Charleville, Quilpie, Tambo, Blackall; Northern districts, including Julia Creek, Richmond, Sellheim	Pastoral districts over which mainly adult swarms of various size and density were observed.

2. *Gastrimargus musicus* Fabr., known as the "yellow-winged locust"—

Dalveen, Texas, Goondiwindi, Tambo	Occasional specimens collected.
Richmond, Hughenden, and otherwise widely distributed in North-west Queensland	Important as pasture pest in the North.

3. *Austacris proxima proxima* Walk.—

Tara, Goodiwindi, Tambo ..	Occasional specimens collected.
Julia Creek, Cloncurry, N.Q. ..	Fairly important as a pasture pest in the North.

4. *Phaulacridium gemini* Sjostedt—

Glenarbon, Texas, Riverton ..	Important as a pest on young tobacco.

Of the following species, only occasional specimens were collected at the centres mentioned against each:—

5. *Caledia propinqua* Walk. ..	Dalveen, Texas, Goondiwindi.
6. *Oedaleus australis* Sauss. ..	Toowoomba, Texas, Cunnamulla.
7. *Aiolopus tamulus* Fabr.	Westbrook, Texas, Goondiwindi, Richmond.
8. *Acrida turrita* Linn.	Dalveen.
9. *Pycnostictus seriatus* Sauss. ..	Dalveen.
10. *Monistria* sp.	Dalveen.

Position in South-eastern Queensland.

Several small-scale invasions had occurred some time prior to the main outbreak in Southern Queensland, but their significance was not realised until the main attack appeared. For instance, during the preceding three or four years, flying grasshoppers from New South Wales had crossed the McIntyre River, which constitutes the State border at Goondiwindi, and invaded holdings in Queensland. Neither the degree of the invasion nor the area occupied seem to have been very great, except in the case of swarms that were reported as having been dense in April-May, 1934.

In parts of the Kooroongarra-Millmerran-Pittsworth area flying swarms of grasshoppers were said to have been common from the end of March until the beginning of May, 1934. The swarms were very dense and caused considerable damage to pastures, young cereals, and other fodder crops. Extensive egg-laying was observed by the farmers, but as the swarms diminished and a period elapsed during which hoppers did not emerge, it was locally thought that the trouble was at an end. Egg-laying, however, had been very considerable, and the non-emergence of hoppers was simply due to the cold weather.

Early in September, 1934, young hoppers were noticed, and by the middle of the month the size and density of the swarms were alarming. About the same time hoppers emerged in the Goondiwindi-Yelarbon districts. Control measures were not then thoroughly organised, and countless survivors completed their development by the end of October. Dense swarms of adults commenced to traverse the country about 1st November, the general migration in the Goondiwindi area being to the east and north-east. At the same time further swarms crossed the McIntyre River into Queensland.

Oviposition was first noted on 3rd November, when a large egg-bed, an acre or more in extent, was located at Goondiwindi. Hopper emergence commenced on 22nd November—an incubation period of nineteen days. The egg-period for this brood varied from nineteen to twenty-one days.

The Inglewood district suffered two mass invasions of flying adults, these occurring on 2nd and 3rd November and again from 13th to 25th November. A somewhat dispersed population persisted for approximately the whole month of November. Oviposition occurred at numerous


MAP OF
QUEENSLAND
Showing the distribution of C. terminifera
observed during the 1934-35 outbreak.
Areas Infested by the Spring generation, 1934.
Areas Infested by the Summer generation, 1934-35.
Far Western and Northern areas infested in the Summer of 1934-35.
Principal swarm movements
Routes followed in survey trips.
Gulf of Carpentaria
Cape York Peninsula
NORTHERN AUSTRALIA
CENTRAL AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
MOSSMAN
CAIRNS
TOLGA
Herbert River
TOWNSVILLE
AYR
Burdekin River
SELLHEIM
CHARTERS TOWERS
Saxby River
Flinders River
JULIA CREEK
CLONCURRY
RICHMOND
HUGHENDEN
CLERMONT
Tropic of Capricorn
ROCKHAMPTON
Fitzroy R.
Dawson R.
SPRINGSURE
ISISFORD
CALLIDE
Callide Ck.
TAMBO
Ward River Road
AUGATHELLA
ADAVALE
TAROOM
CHARLEVILLE
MITCHELL
ROMA
MORVEN
WALLUMBILLA
QUILPIE
SURAT
TARA
TOOGOOLAWAH
JONDARYAN
St Helens
TOOWOOMBA
PITTSWORTH
BRISBANE
MILLMERRAN
LEYBURN
KOOROONGARRA
CUNNAMULLA
EULO
INGLEWOOD
DIRRANBANDI
GOONDIWINDI
Macintyre R.
TEXAS
140°
145°
150°
15°
20°
25°
29°

places, and control work aiming at hopper destruction was somewhat complicated by the inevitable overlapping of generations that followed.

The first adults from this generation were flying in the Goondiwindi district on 4th January, 1935.

Various parasites and birds did excellent work, particularly during the second generation, and these, together with the control operations, considerably reduced the pest population. Weather conditions were also unfavourable for the pest. The rainfall towards the end of the year was above average in the districts concerned, and culminated in exceptional falls giving flood conditions. Large numbers of grasshoppers were found dead in creeks and low-lying ground. This phenomenon was not personally investigated, and it is uncertain whether grasshopper

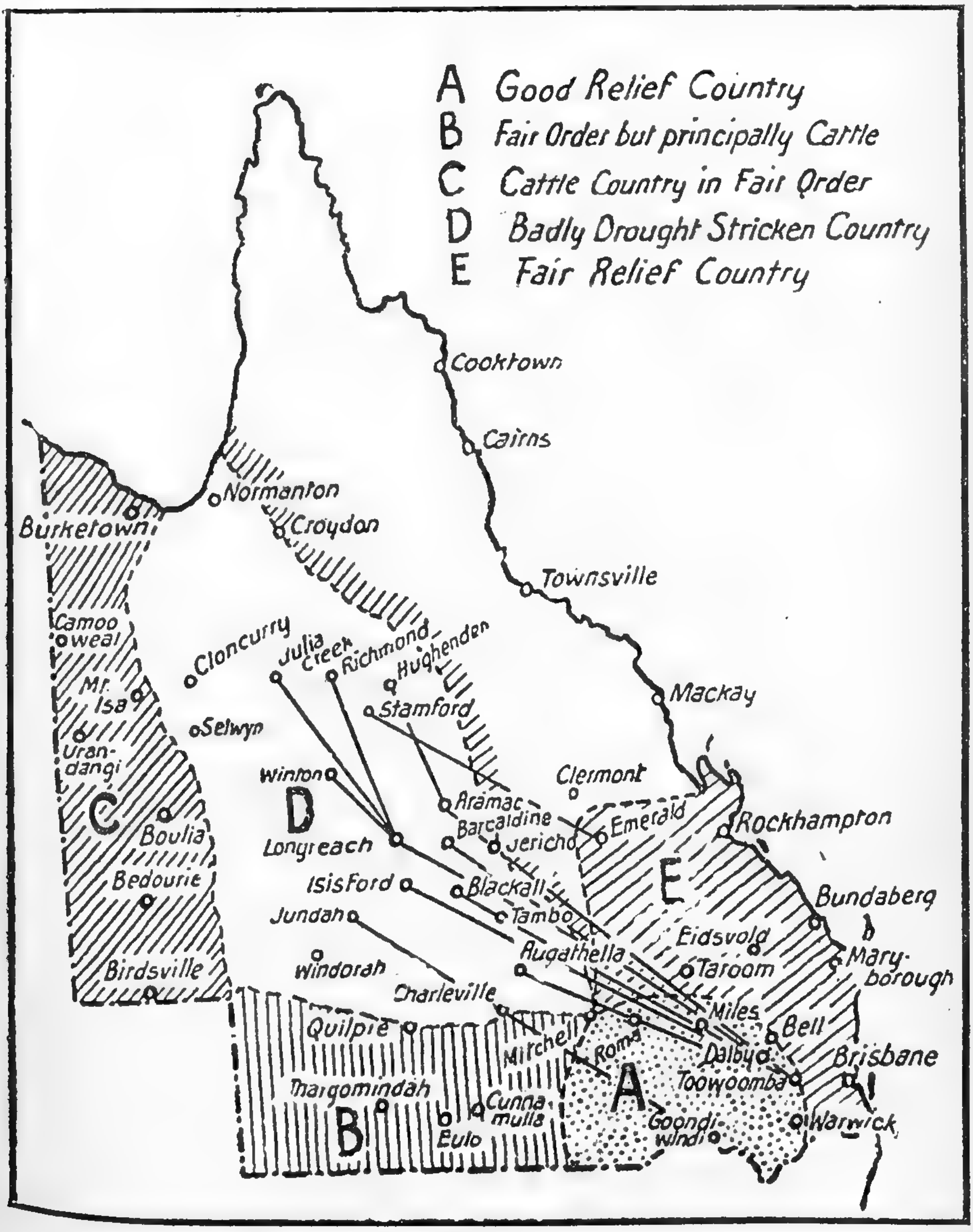


Plate 74.

From the "Courier-Mail," Brisbane, 23rd February, 1935, showing the condition of the country at the time.

destruction was due to drowning or pathogenic organisms aided by the moist conditions. The probability is that both factors were operative.

The last record of breeding at that time was from the Yarranlea district, where hoppers emerged in the second week of January, 1935. These were almost certainly delayed second-generation insects, as in that district insufficient time had elapsed for the development of another brood.

A slight recrudescence of grasshopper trouble occurred in portion of the Goondiwindi-Texas country in November, 1935, when a report from the resident stock inspector indicated that small numbers of hoppers were hatching. The outbreak was on quite a small scale, and the situation did not develop further.

In the 1934-35 outbreak, concerted measures were necessary for the control of *C. terminifera* only. At first baiting was confined to the Pittsworth-Kooroongarra and the Goondiwindi districts, the latter being more correctly referred to as the Waggamba Shire. However, with the second generation, the infested areas had markedly increased, giving practical coalescence (Plate 73). Agricultural activities in the north-easterly portion of this area, particularly in the direction of Millmerran and Pittsworth, are varied, and include wheatgrowing and dairying. The main wheatgrowing areas on the Darling Downs are comparatively close. The grasshoppers were therefore not only a serious pest in the areas first invaded, but a potential menace to valuable adjacent country. The Goondiwindi district is pastoral country, carrying sheep mainly, and here again the pastures were attacked. Some graziers claimed that the carrying capacity of their holdings was temporarily reduced by amounts varying up to 25 per cent., and there was no reason to doubt this estimate.

On pastures that were eaten bare by the grasshoppers, early regrowth followed only if growing conditions were good. For instance, certain areas that were eaten out during the previous April-May, 1934, remained bare for several months, including the winter period. Fortunately, regrowth in pastures eaten during November and December was very rapid, the weather being warm and exceptionally moist. The contemporary rainfall at the time was therefore doubly beneficial both in rounding off the control operations and in stimulating pasture recovery.

The value of the Goondiwindi district and surrounding areas was well demonstrated early in 1935. The summer of 1934-35 was a serious drought period for large areas of Central and North Queensland. A useful map (Plate 74), reproduced here by courtesy of The Queensland Newspapers Pty. Ltd., was included in an article published in the "Courier-Mail" on 23rd February, 1935, describing the pastoral position at the time. It will be observed that the south-eastern area in question was rated as good relief country capable of carrying considerable numbers of stock on agistment.

Crops were variously attacked by the insects. Swarms which destroyed a variety of other plants left tobacco untouched. Potatoes were stripped bare, but under suitable growing conditions satisfactory recovery took place and a crop was produced (Plates 75 and 76). Several patches of lucerne were destroyed by flying swarms, a typical example being shown in Plate 77; in this case flying swarms frequenting the crop for two days stripped 10 acres ready for cutting. Similarly, oats were stripped (Plate 78), while other fodder crops such as Sudan grass were eaten to the ground. Young wheat was completely destroyed

by hopper swarms, being eaten out on a face. The flag of half-grown wheat was taken by both hoppers and adults, but usually these plants made a recovery. Adults attacking mature wheat fed on the ear, often also cutting the stalk (Plate 79).

Secondary losses occurred in one or two instances. In a misguided attempt to use crops that were threatened by hoppers, certain farmers ran dairy cattle on young Sudan grass, which is not normally grazed. A number of deaths unfortunately followed, due to prussic acid poisoning, and indirectly added to the toll levied by the grasshoppers.

Practically all vegetable crops were stripped bare, or, if young or succulent, the plants were eaten to the ground. This damage was important in western districts generally and on large holdings which need to be self-supporting as regards fresh green vegetables.

Plate 75.
Potato crop stripped by flying swarms.
[*Photo. N. A. R. Pollock.*

The significant features in the south-easterly phase of the outbreak may be stressed as follows:—

1. The insects were present in large numbers, causing very definite losses.
2. The country infested was valuable, and closely settled areas slightly further east were menaced by the possibility of grasshopper movements in that direction.
3. The size of the holdings was not, as a rule, too large to prevent the successful adoption of effective control measures.

Position in South-western Queensland.

West of the Goondiwindi area small-scale infestations were located in the vicinity of Talwood, and south of Dirranbandi, in November, 1934. These represented migrations from the south. Some breeding took place, but there was no tendency towards district-wide infestation. Occasional reports also were received from points further west, notably Eulo (October), Charleville (November), and Tambo (December). In order to obtain some idea of the status of these infestations in relation to the south-eastern phase, a rapid survey of the southern and western

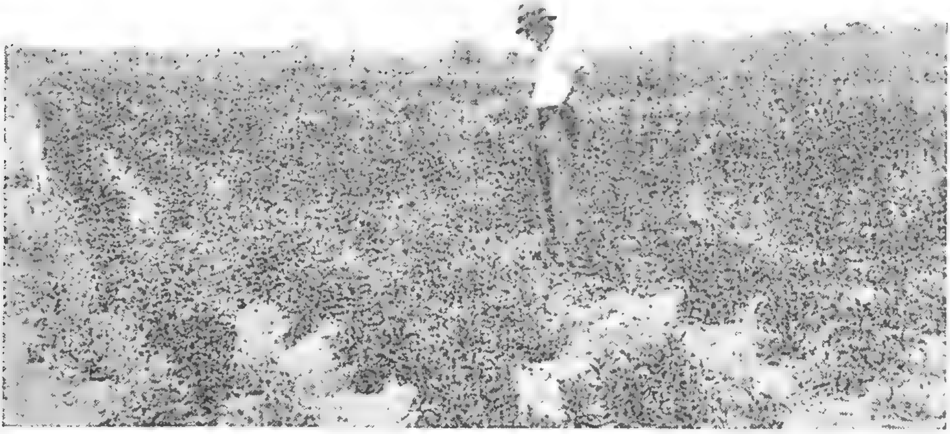


Plate 76.
Showing regrowth of the potato crop illustrated in Plate 75 after four weeks.
[Photo. N. A. R. Pollock.

areas was made early in January, 1935. The route followed is indicated on the map.

The map shows diagrammatically the significant features of the grasshopper position as determined both by observation and by enquiry. No sign of grasshopper activity between the infested south-eastern areas and a point about 30 miles east of Cunnamulla was observed. Here a dispersed swarm of adult grasshoppers was located. Much of the intervening country had been open forest on poor sandy soils growing coarse grasses. Isolated areas of Mitchell grass flats were not uncommon. It

Plate 77.
Remains of lucerne crop destroyed by flying swarms infesting patch for two days.

was on such an area, carrying at the time poor herbage—mainly stunted saltbush—that the grasshoppers were found. In travelling westward, timbered red-soil country free from hoppers and the open areas with light grasshopper populations alternated until the country opened out into the Mitchell grass plains, commencing some few miles east of Cunnamulla. On a pastoral station 10 miles east of Cunnamulla adult grasshoppers were fairly dispersed over wide areas, but with a heavy concentration along the bore drains. Conditions were very dry, and there was little grass away from the edge of the bore drains, the main herbage

Plate 78.
Oats stripped by flying swarms.
[*Photo. N. A. R. Pollock.*

being only stunted saltbush 6 inches high. The grasshoppers were feeding, but the concentration was not sufficient to cause serious damage.

Late in December a heavy swarm—the largest that had been seen in the district for some years—was reported to have passed over, travelling north. A similar swarm had apparently swept over the southern border during December from New South Wales and moved north in the direction of Cunnamulla. There seems little doubt that these records refer to the same migrants.

From Cunnamulla to Tambo scattered swarms of various dimensions were encountered, flying always with a generally northerly trend. Adult grasshoppers were said to be common further west, but there were few indications of the pest occurring in numbers very far east of the line joining Cunnamulla and Charleville. Swarms were reported from at least as far west as Quilpie and Adavale. North of Charleville, on the Ward River road, several reports of grasshoppers were received to as far as Tàmbo. In most cases a northerly flight of the adults had been noticed. So far as the observations went, the grasshopper density increased northwards, and this may possibly have been due to the overtaking of migrating swarms that had been reported to be passing northwards. Near and into Lansdowne Station, south of Tambo, a huge swarm of flying adults, the swarm extending 20 miles north and south, was encountered, the flight direction being almost due north.

Beyond the limits of the migrant swarm just mentioned the infestation on this property was widespread. There was marked concentration of the insects along the bore drains and in slight hollows. The grasshoppers had arrived in two main swarms, the first being about the third week of December, and the second during the first week of January.

Much of the country was drought-stricken, and a few points may be worthy of mention. There was practically no green feed for the grasshoppers, except the tiny shoots of herbage on the drain margins. This paucity of feed may account for the fairly rapid migration of the insects. Many observers felt that even large swarms wandering haphazardly over such parched country would make little difference to the graziers' losses.

Plate 79.
Wheat showing loss of ear; adult grasshoppers invaded and damaged the portion to the right.

Conversely, in good seasons the stock carried on western lands could consume only part of the available fodder, and it would appear that even a considerable grasshopper population would not appreciably reduce the carrying capacity of the properties. The insects are more or less common every year in these parts of the State, the noteworthy feature during the period under discussion being the much larger and denser swarms that were present. Even so, there were large areas between swarms on which it would have been difficult to collect grasshopper specimens.

Swarms were reported as having passed through the Tambo township early in January, moving in an easterly direction. Other reports were received of flying swarms up to 100 miles west of Tambo.

Apparently little or no breeding had taken place in the Cunnamulla-Tambo country, for only the flying insects were seen by the writer, and few residents were aware of the breeding habits. Only one station-owner had noticed egg-laying and hopper swarms, on a small area, and a few had seen the mating and clustering of adults which normally precede egg-laying. Large or widespread breeding grounds such as could give rise to the extensive swarms were quite unknown. Certain

areas on which clustering had been observed were thoroughly examined, but although the general soil conditions of these areas seemed suitable for oviposition, no evidence that it had occurred could be discovered.

Grasshoppers occurred sporadically along the stock route from Tambo to Augathella and in the neighbouring properties in the plains country until the timbered country was entered, about 20 miles north of Augathella. With the change in vegetation there was a complete cessation of grasshopper occurrence. A few hoppers were seen on isolated timber-free areas between Augathella and Morven, but no worthwhile pasture destruction had been recorded.

The Morven district was badly in need of rain, but towards Mitchell and further east there was feed in abundance. Swarms of half-grown hoppers were encountered on the road a few miles east of Mitchell, and on some properties grasshoppers had been present since late November. On one property baiting work on a big scale had been necessary and had given good results. The infestations were, however, quite patchy, fortunately not being of the general nature seen in the Goondiwindi and allied areas.

Roma district showed even better growth than Mitchell, and the grasshopper position was of much less importance. Only a few properties appeared to have been affected, and these to only a small degree. At Surat nothing was known locally of any grasshopper trouble. This district was more or less isolated from infested areas by timber barriers, and these, together with the fairly general timber cover still existing, ensured some protection against invasions from elsewhere.

At Glenmorgan, about 60 miles east from Surat, grasshopper infestation on a property south on the Moonie River was reported. This appeared to represent the northernmost extension, in that locality, of the Goondiwindi infestation. As has elsewhere been indicated, there were minor outbreaks at Wallumbilla, Tara, and Jondaryan, where two small generations occurred in the spring and summer months.

The main impressions gained from the survey were as follows:—

1. The really serious economic infestation had been correctly recognised early in the campaign as covering the Pittsworth, Millmerran, Inglewood, and Goondiwindi areas.

2. The main western infestation occurred on the open plains country, and its eastern margin was delineated by the western margin of the main timber belt which follows a line drawn somewhat east of Cunnamulla and Charleville. The area involved was at least 100 miles wide east and west, no information being obtained from points further west, and extending from the southern boundary of the State northwards. A dispersed grasshopper population is usual to this territory, but during the period from November, 1934, to January, 1935, there was a marked increase much above the usual in the numbers of the pest.

3. The country in between the infested south-eastern and south-western areas was comparatively free from grasshoppers, except for a few sporadic outbreaks.

4. The control of grasshopper infestations of a general nature in the western country, consisting as it does of large pastoral holdings, was quite impracticable, except in isolated cases. In this connection, therefore, it was important that there were few records of actual breeding. It would be difficult in that country to assess the losses—if any—caused by the pest.

Position in North and North-western Queensland.

During January, 1935, Mr. J. H. Smith visited several western districts, including Julia Creek, Hughenden, and Charters Towers, and investigated reports of grasshopper activity.

Three species of grasshoppers were implicated in the outbreaks, these being *Gastrimargus musicus, Austacris proxima proxima,* and *Chortoicetes terminifera.* The three species will be separately discussed.

In the past the more spectacular flights of grasshoppers in the North-west appeared to be due to the species *G. musicus.* The only authenticated record of breeding immediately prior to the visit was near Richmond, hoppers showing a considerable colour variation being seen in October and November, 1934. The adults migrated from these breeding grounds early in December towards the cattle stations of the Gulf and the Cape York Peninsula. The species is widely distributed in North Queensland. There can be little doubt that the occasional outbreaks in cane on the coast can be ascribed to this species; it has not, however, been implicated in the injury reported in other crops—*e.g.,* tobacco, tomato, and sundry vegetables.

The comparatively large species, *Austacris proxima proxima,* was present on most western properties. In the more drought-stricken districts, adults swarmed round the homestead greenery, and vegetable gardens were almost wiped out; the foliage was stripped from fruit and shade trees, while the bark was frequently gnawed from the twigs and lesser limbs. Only the oleander came through unscathed, while the saltbush in common use as hedge was less attractive than most other plants. Graziers contended that this insect was most active in the more heavily timbered country, particularly in the vicinity of the Flinders and Saxby Rivers. Certainly adults were much more common in January in the cattle country thereabouts than elsewhere, but fair rains had fallen previously; and the recent growth may have drawn them from the less favourable country lying to the south.

The plague species, *C. terminifera,* was apparently quite familiar to the graziers. It was very common wherever green feed was to be found in the sheep country adjacent to the north-west railway line. Towards the north it yielded place to the larger species already discussed, but for the most part both forms existed side by side. Hughenden seemed to have been invaded much later than centres further west. As already mentioned, the slight hopper outbreaks in October and November, 1934, were mainly due to the larger species, and an invasion from the south was generally postulated to explain the presence of *C. terminifera.* Only one relevant piece of information came to hand to support this. A large swarm passed over a property at Ruthven, in the Isisford district, south of Hughenden, on 22nd December, 1934, then travelling north and making no attempt to settle locally. The insects present in Hughenden in January showed a more or less dilatory flight a few feet from the ground during the morning hours in an easterly direction.

So far as the three species were concerned, the position at the time of the survey was as follows:—*G. musicus* was quite absent from the country under review; *A. proxima proxima* was dominant in the vicinity of the Flinders River, but occurred sporadically elsewhere; *C. terminifera* was the most important species in the sheep country as far west as Julia Creek and east to Sellheim. Nearer the coast, occasional

individuals were to be found, but the grasshopper fauna was of the mixed type usually associated with the wetter areas.

Dissections of a large number of adult females of *C. terminifera* and *A. proxima proxima* were made. The ovaries in *C. terminifera* were quite undeveloped and occupied a small part of the body cavity. On the other hand, the ovaries of *A. proxima proxima* contained well-defined and fully formed eggs. In many insects the distended ovaries occupied the greater part of the abdomen and extended well into the thorax, giving the impression that egg-laying was imminent.

In considering the significance of grasshopper outbreaks in the North, Mr. J. H. Smith discussed the matter as follows:—

Though the damage to station gardens and fruit and shade trees was considerable, adverse troubles of this kind have little effect on the commercial wellbeing of the graziers. Enquiries into the effect of grasshoppers on the feed distributed over the run elicited a variety of opinions, but generally the insects are not regarded as serious pests. Hopper swarms have occasionally overrun a property and destroyed much of the grass, but appreciable losses through the adults have not so far been recorded. In any case such losses would be difficult to estimate, for their importance depends on the growing conditions at the time and the numbers of stock carried on the property.

March outbreaks of either hoppers or adults would invariably be a less serious matter than spring plagues of the insect. At that time of the year the ground is, as a rule, well soaked with rain, and, as growing conditions are good, the ravages of the pest are made good in a very short time. Spring outbreaks are, however, a more important matter. Fodder reserves are frequently reduced to a minimum at that time, and any abnormal depletion may compel the grazier to send his stock to agistment pending the recovery of his run when the summer rains fall —usually in February.

The relative importance of hoppers and adults in pasture losses is difficult to determine. Hopper injury has in the past been more spectacular. The dispersed adult phase was, however, common to the whole district, and must have caused appreciable injury in 1934, when feed was comparatively scarce. In January, 1935, the adult phase alone was of any consequence.

Possible Climatic Association.

Attempts to explain the original appearance of the grasshopper plague in the Millmerran Shire can only be conjectural. The insect normally frequents the drier areas of the State; yet for several months prior to the invasion rainfalls were generally above the average in the more important grasshopper-infested districts. Table 1 gives the monthly rainfall records in Millmerran for the period June, 1933, to May, 1934, together with the respective monthly means. Months in which more than average rain fell are indicated by an asterisk:—

TABLE 1.

Rainfall.	1933.							1934.				
	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
Actual	200	228	129	270	236	514	360	320	507	5	149	39
Mean	189 *	158 *	115 *	136 *	192 *	263 *	301 *	321	290 *	253	146 *	147

TABLE 2.—SHOWING THE MONTHLY RAINFALL RECORDS FOR 1934 AND THE MONTHLY MEANS (IN ITALICS BENEATH) IN THE SOUTHERN DISTRICTS OF QUEENSLAND HAVING SOME ASSOCIATION WITH THE GRASSHOPPER INCIDENCE OF 1934.

* Indicates month in which rainfall was above average.
H Indicates presence of hopper swarms.

A Indicates presence of adults in swarms.
E Indicates presence of eggs.

District.	Rainfall.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Districts little or not infested.													
Toowoomba	Actual	542	1,088	23	628	134	111	381	140	87	312	365	738
	Mean..	*508*	*460*	*367*	*266*	*216*	*242*	*210*	*165*	*213*	*256*	*338*	*446*
		*	*		*			*			*	*	*
											A. & H. small numbers		
Allora	Actual	376	353	4	316	25	94	332	107	104	298	303	786
	Mean..	*395*	*290*	*236*	*180*	*158*	*176*	*171*	*126*	*180*	*217*	*266*	*324*
			*		*			*			*	*	*
		No infestation.											
Districts Infested in which Heavy Breeding Occurred.													
Pittsworth..	Actual	308	364	0	505	120	83	276	67	78	228	344	876
	Mean..	*379*	*308*	*297*	*174*	*141*	*180*	*180*	*119*	*165*	*217*	*287*	*364*
			*		*			*			*	*	*
				A	A	A	E	E	E.	H	H	A E H	A E H
Millmerran	Actual	320	507	5	749	39	70	229	151	68	349	480	901
	Mean..	*321*	*290*	*253*	*146*	*147*	*189*	*158*	*115*	*136*	*192*	*263*	*301*
			*		*			*	*		*	*	*
				A	A	A	E	E	E	H	H	A E H	A E H
Goondiwindi	Actual	134	422	5	53	101	115	199	164	78	377	247	446
	Mean..	*290*	*257*	*249*	*154*	*173*	*185*	*176*	*125*	*151*	*180*	*228*	*299*
			*					*	*		*	*	*
				A	A	A	E	E	E	H	H	A E H	A E H
Inglewood	Actual	266	433	33	246	7	68	274	180	145	356	174	880
	Mean..	*321*	*278*	*257*	*134*	*173*	*190*	*182*	*130*	*166*	*216*	*267*	*310*
			*		*			*	*		*		*
												A E H	A E H
Texas	Actual	266	284	60	158	35	142	263	237	100	506	273	769
	Mean..	*331*	*258*	*223*	*155*	*156*	*192*	*186*	*141*	*161*	*216*	*234*	*320*
								*	*		*	*A E H	*A E H
Districts Typical of the South-west carrying Swarms of Adults towards the end of the Year.													
Cunnamulla	Actual	18	155	0	129	15	132	116	83	25	268	219	16
	Mean..	*126*	*210*	*138*	*113*	*115*	*120*	*90*	*67*	*36*	*91*	*106*	*160*
					*		*	*	*		*	*	
				No special records									A
Tambo	Actual	102	276	38	222	11	91	197	0	12	93	50	23
	Mean..	*286*	*303*	*258*	*146*	*143*	*127*	*116*	*76*	*89*	*139*	*189*	*261*
					*			*					
				No special records.									A

It will be seen that in the month of March, 1934, only 5 points of rain fell in the Millmerran district. The migratory adults arrived about this time and found an excellent body of feed, which enabled them to flourish and lay a full complement of eggs. The serious infestation in the district may then possibly be explained by the following sequence of events:—

1. A building-up of grasshopper population in some contiguous locality (the nearest record was from the New South Wales border at Goondiwindi);
2. Suitably dry weather conditions coinciding with the appearance of a swarm of winged adults;
3. The earlier rain ensuring a fine body of feed locally.

This correlation is purely tentative both from the point of view of the origin of the first swarms and with regard to the rainfall association. Information within the district was quite conflicting as to the direction from which the swarms first appeared. This was probably due to the extensive circling flights that took place within the district. The insects thus appeared to the several farmer observers to come from different compass points. It is possible that these swarms flew in from Goondiwindi in an indirect line, proceeding first north and then east. The invasion did not arrive by way of Inglewood, for the whole of this area was continuously free until the 1934 spring brood became adult and invaded the area travelling north-easterly from the direction of Yelarbon. Had the earlier swarms passed over Inglewood district, the insects would have found conditions there similar to those in Millmerran, and, of course, their passage would have been noted. Residents at Kooroongarra were emphatic in their statement that, prior to the autumn of 1934, grasshoppers had been practically unknown in the locality, and that the adult swarms that were prevalent in that autumn had not developed in the district.

The further spread of the insects that occurred in November, 1934, is not explicable by the low rainfall theory, as all of the recording stations within the district as a whole showed rainfall totals higher than the average for the months of October and November. The ultimate disappearance of the grasshoppers as a plague was in part linked with heavy rainfall, for by the Christmas period flooding effects were common.

The accompanying rainfall table (Table 2) may be of some interest in relation to the incidence of *Chortoicetes terminifera*. In this table will be seen the high rainfall totals in the main grasshopper-infested districts for the months of October, November, and December.

[TO BE CONTINUED.]

Carcass Quality of Bacon Pigs.

E. R. HOLLAMBY, Inspector of Slaughter-houses.

THE type of pig suitable for bacon curing is frequently a subject of inquiry. Local market requirements are a dressed carcass weighing from 95 to 120 lb., producing finished sides from 38 to 42 lb. Bacon pigs should be so slimmed, as it were, that the back fat at the shoulder shall not exceed 1¾ inches, tapering to ¾ inch at the loin.

The British market requires a slightly heavier carcass, weighing from 130 to 160 lb., with dressed sides ranging from 56 to 65 lb., and so slimmed that the fat at the shoulder shall not exceed 1¾ inches, tapering to ¾ inch at the loin.

Some pigs cannot slim. Briefly, the type of pig that can slim must be long and have fairly well sprung ribs, with fine bone and skin and hair of fine texture. These essentials put nondescripts and mongrel-bred pigs right out of consideration and place a limitation of choice on breeds or crosses that supply the requirements of the trade.

Some breeds are so short and predisposed to fat that they simply cannot comply with the essential conditions. Given suitable housing and conditions, feeding has a most important influence in developing the characteristics required—the development of the thickness of lean meat without getting too much fat, which is the main problem in pig production to-day.

It is the protein in the food that produces lean flesh. The fats, carbohydrates and digestible fibre provide heat and energy and form fat, but cannot make lean meat. The baconer must produce plenty of lean flesh with only a moderate amount of fat if it is to grade well on slaughter. Although it is not possible to convert a fat matured pig into a clean fleshed animal simply by feeding it on protein-rich food, it is, nevertheless, true that a potentially lean fleshed pig can be converted quite easily into an overfat carcass by improper feeding.

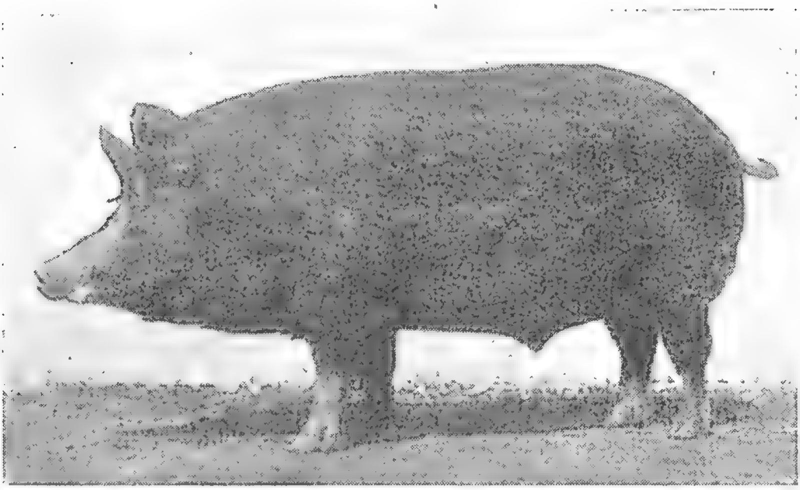


Plate 80.

Champion Prize-winning Tamworth boar, Zillvale Skipper, owned and exhibited by Wide Bay Stud Piggery, Gympie, Q. Zillvale Skipper is probably the most successful Tamworth boar exhibited at Brisbane R.N.A. and other Shows for many years, for, in addition to winning championships at Brisbane, he has been most successful at other Shows. He is a reliable stock-getter, and his progeny are in great demand.

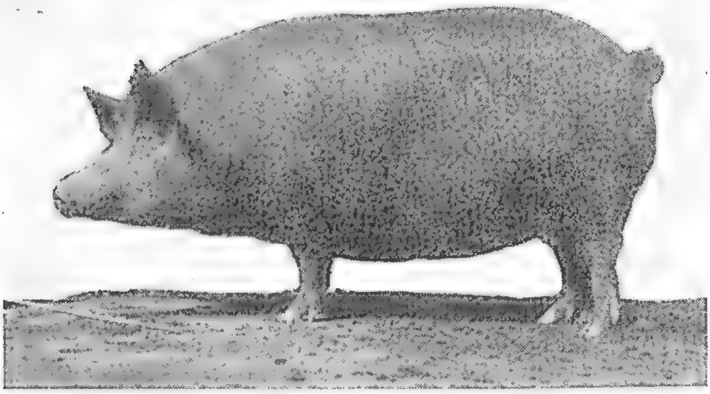


Plate 81.

Champion Prize-winning Tamworth sow at Brisbane Exhibition, 1936. This sow, shown by Wide Bay Stud Piggery, Gympie, is Wattledale Trilby, assuredly one of the best of her breed in the State. Note deep, lengthly body, well-developed hams, and neat, attractive carriage of this well-known animal, winner also of many prizes at country Shows.

The various points which go to make up good carcass quality are mainly a matter of body proportions and composition, which do not remain constant but change as the pig grows. In the pork type, they change quickly so that they are right, i.e., small proportion of head and bone and high proportion of loin and lean meat with just the right amount of fat—½ inch over the loin—at 70 to 80 lb. dressed weight. In the bacon type, these proportions are not attained until the pig reaches bacon weight. The proportions required by the consumer are the same for both pork and bacon pigs, but the weights at which these two types arrive at these proportions differ, the one being early maturing and the other late maturing. The difference between pork and bacon pigs is mentioned so that farmers may realise the difference between the two types.

Plate 82.

Large White boar, Highfields Faithful 10th, winner of Reserve Championship at Brisbane Exhibition and of prizes at other Shows in the State. This boar, shown by Mr. J. A. Heading, of the well-known Highfields Stud at Murgon, is of a long, compact type, neat and attractive, light in the forequarters, and showing plenty of character. The Large White of to-day is a much superior animal to that of former days.

The various points required in the dressed carcass, if it is to grade well, are:—

The back fat forms a good measure of the fatness of the carcass generally, and to-day the public do not require very fat bacon. The fat is always much thicker at the shoulders than at the loin in a young pig, and the difference in ratio between these two parts narrows gradually as the pig grows. Thus a back fat tapering gradually from shoulder to loin is an indication that a carcass has not yet attained its full maturity and fatness; such carcasses are required for bacon production. The pork types—being small, short, blocky, and early maturing—carry more fat at bacon weight than do the larger, longer and later maturing bacon types. By lengthening the pig, the chances of getting too thick a back fat are reduced. On the same feed, sows usually grade better than barrows in respect of back fat measurements. A soft, oily fat is objectionable to the consumer and curer; as firm a fat as can be produced is required. This is influenced more by feeding than by the breed, except that slow growing pigs tend to have a softer fat than fast growing ones.

Plate 83.

Champion Large White boar at the Brisbane Exhibition, 1936, and winner of many other champion prizes. Mr. J. A. Heading has in Gatton David a Large White he can be justly proud of, because this boar has a type and conformation sought by pig raisers in every breed. His length, depth, light forequarters, and an even temperament are features that stamp him as an excellent sire of quality stock.

Plate 84.

The imported Large White sow Grinton Sunbeam, winner of Female Championship in Large White Section, Royal National Exhibition, Brisbane, 1936. After winning her championship she returned home to produce a litter of nineteen pigs. Her progeny are in constant demand, and she has proved a most profitable animal, upholding the world-wide reputation of the pig as a rent-payer and a mortgage-lifter.

Plate 85.

Championship Berkshire boar at Brisbane Exhibition, 1936, shown by Queensland Agricultural High School and College, Lawes, Q. This boar, Grafton Jock, is of the latest English type, and has a long, deep, masculine body, well-developed hindquarters, and is nicely marked, as is required in this breed. He has also been successful at many country shows.

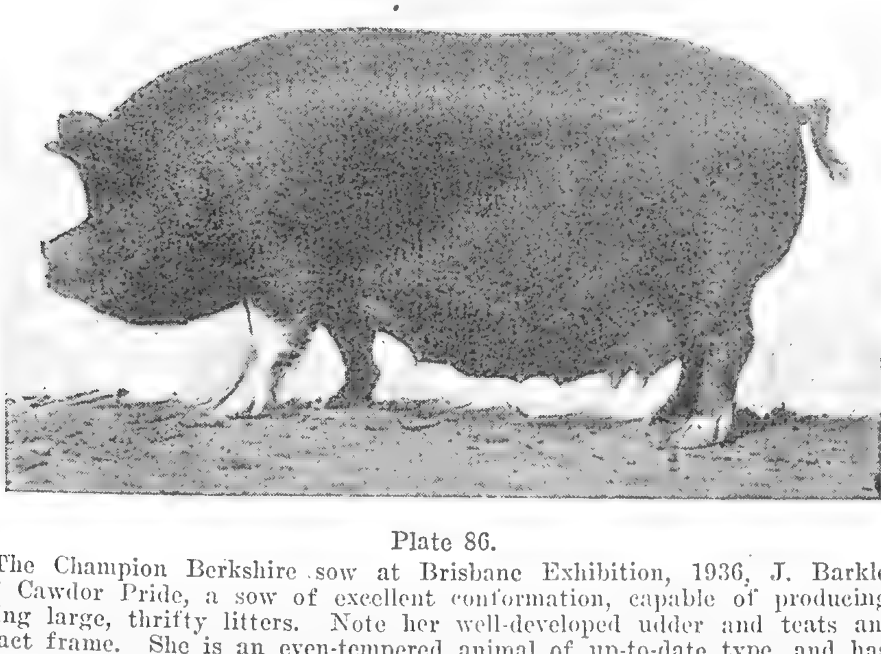


Plate 86.

The Champion Berkshire sow at Brisbane Exhibition, 1936, J. Barkle and Sons' Cawdor Pride, a sow of excellent conformation, capable of producing and suckling large, thrifty litters. Note her well-developed udder and teats and her compact frame. She is an even-tempered animal of up-to-date type, and has won for her owner many premier awards, including sow and litter class at Brisbane in 1935.

The consumer requires a thick streak of lean meat, and this should be obtained by developing the thickness of the muscle or lean meat without getting too much fat. On the young pig, bone reaches its maximum growth first, then muscle, while fat makes its maximum growth later. This knowledge provides a sound reason for weighing pigs at regular intervals after weaning, for it is just after this time that the lean meat begins to develop; and pigs which grow well then will grade better than those whose growth is checked at this stage.

At birth the ham is nearly all bone and poorly fleshed, while as the pig grows the bone becomes proportionately smaller and the meat is "let down" to the hocks. A good ham is one in which these age changes are well developed. The ham should be fleshy, well rounded, deep and broad. Width of the buttock just below the tail is a character that could be improved in many pigs.

Apart from the fact that a pig which is long for its weight will tend to have less fat than one which is short for its weight, length is required in order to give a larger portion of back cuts as compared with belly cuts, for the former are higher priced than the latter. A thick streak is required, but not a long one (so as to form a good rasher) and this compared with the live pig means one which is not too deep at the time of slaughter and one which has a clear cut straight underline; such a pig will appear to be long for its weight. One requires the type of pig which at bacon weight has only just begun to deepen; otherwise it is likely to be deficient in thickness of streak, for this is partly a question of maturity.

The shoulder is a low priced part of the carcass compared with the loin, and should be reduced as far as possible.

A coarse-skinned pig grows a thick rind which detracts from the bacon when it comes to be sold—hence the skin should be of fine texture. Many of these qualities cannot be determined until after the pig is slaughtered. Testing the offspring of breeding stock for carcass quality, and using the parents of those which test out best as the foundation of the next generation of breeding stock (and they should be kept and used as long as possible for producing breeding stock) is the only means of ensuring a sound breeding policy. It is important when these tests are being made that the nutrition should be suited to develop the characteristics that are required. Otherwise little progress will be made by selection, for the quality selected will be limited by the nutrition and not by the breed qualities of the animal.

SOME NEW BOOKS.

Quite a lot of new books have been added to the library list issued by the Tutorial Classes Library, which supplies a special postal library service for country residents. This is a first-class library of excellently-chosen books. Books on almost any subject and all the best types of fiction may be borrowed.

The Tutorial Classes Department has also added to its lists series of talks on several new subjects, such as—Elocution, Debating, Australian Economics, Economic Geography, and Food and Diet. You may get a series of twenty-one talks for 8s. 6d.; if you want to join the library and not bother about these type-written talks, the library fee per year is 18s. 6d. Write for information to the Director of the Department of Tutorial Classes, corner Edward and Ann streets, Brisbane.

Spraying Oil Concentrates.

F. B. COLEMAN, Officer in Charge, and R. A. TAYLOR, A.A.C.I., Inspector and Examiner, Seeds, Fertilisers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch.

OWING to frequent enquiries received by this Branch with respect to types of spraying oils on the Queensland market, it has been considered advisable to publish this article, which may be defined as:—

A classification under the definitions prescribed by the Pest Destroyer Regulations, of the Spraying Oil Concentrates registered for the current year under the Pest Destroyers Act.

The Pest Destroyer Regulations prescribe standards for spraying oils and emulsions as follows:—

(*a*) Light mineral oils and/or emulsions shall consist of preparations containing benzine, benzole, petrol, kerosene, and other light oils which will readily form an emulsion with distilled water.

(*b*) Heavy mineral oils and/or emulsions shall consist of any preparation containing a heavy mineral oil which will readily form an emulsion with distilled water.

(*c*) Tar oils and/or emulsions.

The spraying oils registered for the current year may be divided into these three classes, as set out in table 1.

All of these oil concentrates are in a form which, on the addition of water, gives an emulsion.

Some may be "concentrated" emulsions, consisting of oil, water, and an emulsifier or emulsifiers; others may be "miscible oils," consisting of oil and an emulsifier—without water.

The thorough preparation or emulsification of these concentrates by the manufacturer is an important factor controlling the fineness of division and permanency of emulsion obtained on dilution; of course the emulsifiers used are also of importance.

As may be seen from table 1 almost all of the spraying oils registered contain as the active constituent heavy mineral oil, and consequently fall into class (*b*) of the table in question.

The mineral oil used in this class of spraying oils falls into three distinct groups:—

(1) White oil;

(2) Red oil;

(3) Crude oil.

White oils, although they may in any particular oil concentrate consist of a "blend" of several "named" oils, are pure mineral oils. Generally speaking, they are safer to use than red oils with respect to plant injury, but the properties of the emulsions made from different white oils vary according to the physical properties of the oil or oils and other factors involved (such as emulsifier, &c.).

For instance, certain white oil concentrates are recommended as "dormant sprays," whereas the majority are recommended for "all the year round" application.

TABLE I.

Class.	Name of Spraying Oil Concentrate.	%	Constituents Declared.	Queensland Primary Dealer.
(a)	Light Mineral Oils—			
	Irving's prepared Soluble Spraying Emulsion	62	Kerosene*	John Irving and Sons, Mayne
(b)	Heavy Mineral Oils—			
	Albarol White Oil	83·4	Petroleum Oil (Heavy)	Buzacotts (Qld.) Ltd., Brisbane
	Clarifol	82	Mineral Oil (S.G. ·890)	Neptune Oil Co., Ltd., Brisbane
	C.O.D. Improved Red Oil	75 7	Mineral Oil Cresylic Acid	The Committee of Direction of Fruit Marketing, Brisbane
	Cooper's Alboleum	80	Hydrocarbon Oil	Queensland Fruitgrowers' Society, Ltd., Brisbane
	F.D.L. White Oil	80	Mineral Oil	Fertiliser Distributers Pty., Ltd., Brisbane
	Gargoyle Red Spraying Oil	85	Red Mineral Oil (S.G. ·925)	Vacuum Oil Co., Pty., Ltd., Brisbane
	Gargoyle White Spraying Oil	85	White Oil	Vacuum Oil Co., Pty., Ltd., Brisbane
	Harbas	·75 5·5	Total Mineral Oils (S.G. ·93) Tar Acids	Buzacotts (Qld.) Ltd., Brisbane
	"Neptune" Prepared Crude Spraying Oil	83	Crude Petroleum Oil (S.G. ·948)	Neptune Oil Co., Ltd., Brisbane
	"Neptune" Prepared Red Spraying Oil "A"	85	Mineral Oil (S.G. ·910)	Neptune Oil Co., Ltd., Brisbane
	"Neptune" Prepared Spraying Oil "C"	65 7·5	Mineral Oil (S.G. ·920) Cresylic Acid	Neptune Oil Co., Ltd., Brisbane
	"Neptune" Prepared White Spraying Oil	82	Mineral Oil (S.G. ·87)	Neptune Oil Co., Ltd., Brisbane
	Q.F.S. Red Spraying Oil	80 5·5	Mineral Oil Tar Acids	Queensland Fruitgrowers Society, Ltd., Brisbane
	Shell P.C.S.	83	Crude Petroleum (S.G. ·948)	The Shell Co., of Australia, Ltd., Brisbane
	Shell Red Spray	85	Mineral Oil	The Shell Co., of Australia, Ltd., Brisbane
	Shell White Spray	82	Refined Petroleum Oil	The Shell Co., of Australia, Ltd., Brisbane
	Shellicide "D"	82	Refined Petroleum Oil	The Shell Co., of Australia, Ltd., Brisbane
	United Red Oil Spray	75 7	Mineral Oil Cresylic Acid	United Chemical Co., Ltd., Brisbane
	Vallo Prepared White Oil	89	Mineral Oil	A. Victor Leggo and Co., Pty., Ltd., Brisbane
	Vallo Red Spraying Oil	89	Red Oil	A. Victor Leggo and Co., Pty., Ltd., Brisbane
	Volck	80	Refined Petroleum Oil	A.C.F. and Shirley's Fertilizer Ltd., Brisbane
(c)	Tar Oils—			
	Coopers Ovicide Tar Oil	48 20 10	Tar Oils Mineral Oils Phenols	Queensland Fruitgrowers' Society, Ltd., Brisbane

All percentages declared under the Pest Destroyers Act and Regulations must be weight to weight.

* The Specific Gravity of Kerosene is approximately ·80.

S. G. Specific Gravity.

Red oils are more impure than white oils, and may be refined into white oils.

Crude oil is crude petroleum oil; the use of this product naturally requires more careful control than is necessary with the above oils.

Generally speaking, the specific gravity of the above oils is greatest in crude oil and lowest in white oil; in other words, the specific gravity is lowered by the "refining" process.

A subdivision of class (*b*) of table 1, with respect to the type of oil contained, is set out as follows:—

TABLE II.

Class (b) Subdivision.	Name of Spraying Oil Concentrates.	Specific Gravities of Oils Present as Declared on Respective Labels.
(1)	White Oils—	
	Albarol White Oil	..
	Clarifol	·890
	Coopers Alboleum	..
	F.D.L. White Oil	..
	Gargoyle White Spraying Oil	..
	"Neptune" Prepared White Spraying Oil	·870
	Shell White Spray	..
	Shellicide "D"	..
	Vallo Prepared White Oil	..
	Volck	..
(2)	Red Oils—	
	C.O.D. Improved Red Oil	..
	Gargoyle Red Spraying Oil	·925
	Harbas	·930
	"Neptune" Prepared Red Spraying Oil "A"	·910
	"Neptune" Prepared Spraying Oil "C"	·920
	Q.F.S. Red Spraying Oil	..
	Shell Red Spray	..
	United Red Oil Spray	..
	Vallo Red Spraying Oil	..
(3)	Crude Oil—	
	"Neptune" Prepared Crude Spraying Oil	·948
	Shell P.C.S.	·950

It will be seen from the above that by subdivision into white, red, and crude oil sprays, the concentrates are also subdivided in accordance with the specific gravities of the respective oils contained in them.

It should be noted that in table 1 a number of the oil concentrates are shown as containing cresylic acid as well as mineral oil.

It is not advisable to classify these oils according to the presence or absence of cresylic acid or other tar acid, as this material is not necessarily an "active constituent," but is added as an emulsifier. When comparatively large quantities are present, however, the declaration of same is set out on the label for the information of the purchaser.

A dividing line has been drawn at 3·1 per cent.; consequently spraying oil concentrates having less than 3·1 per cent. by weight of cresylic acid do not declare on their respective labels the presence of such tar acid, while concentrates containing 3·1 per cent. or more disclose this fact.

For the purpose of this article, only materials specially prepared as "spraying oil concentrates" are considered; no recognition is made of pest destroyers which claim "spraying oil uses" as one of many properties.

Summary.—Spraying oil concentrates may be divided first into three classes:—

(*a*) Those containing light mineral oils (kerosene, &c.).

(*b*) Those containing heavy mineral oils.

(*c*) Those containing tar oils.

Class (*b*) contains the bulk of the spraying oils sold in Queensland.

This class may then be subdivided into—

(1) Those containing white oil;

(2) Those containing red oil.

(3) Those containing crude oil.

White oils are "pure" oils, and red oils are purer than crude oils.

The *active constituent* in "spraying oil concentrates" is the oil, and where cresylic acid is declared on the label, this is done because such tar acid, although used as an emulsifier, is present in comparatively large quantities, and this information is considered of use to the purchaser.

GRANADILLA GROWING.

In the growing of granadillas it is most essential that suitable trellising be erected to carry these plants.

The most successful method noted is to plant cuttings (decidedly preferable to the planting of seed) in the field at a distance of 16 feet between each cutting in the rows, and 6 to 8 feet between each row. A wise plan is to plant a greater number of cuttings in each row than are actually required, the grower removing any surplus after a reasonable period has elapsed, such period being long enough for these young vines to take root, and thus establish their certainty of growth. It is necessary for these vines to be trained up on to a trellis and a trellis is erected above them in the following manner:—

Two straining posts, one at each end, are very securely erected. Supporting posts are placed between these two posts at intervals of from 12 to 14 ft. The main wire is strained through the middle of these posts at approximately 5 ft. from the ground. At the top of each of these posts an arm is fastened (a piece of 3 x 2 timber 3 ft. long is ideal for this purpose). Two holes are bored, one in each end), and two additional wires are strained through these holes, thus making a 3-wire trellis to carry the vines.

It is imperative that these vines be trained so that the main leader grows along each of these wires, and it is preferable to have all vines running in the one direction.

Under tropical conditions these vines should come into fruit in approximately eight months. The first crop would be somewhat light; the second crop should be much heavier, and from then on these vines should produce two crops per annum.

The amount of fruit produced is greatly increased if hand pollination is adopted, and although this is quite a tiresome and difficult procedure it gives results that easily repay the grower.

It is particularly hard to estimate the actual weight of fruit produced per acre per annum, as so many factors are responsible. The best granadillas produced in Queensland are from vines growing on the rich alluvial lands just north of Cairns, and fully considering this fact it would appear that in districts as far south as Mackay similar returns would be obtained.

Spray Irrigation.

H. W. KERR.*

SPRAY irrigation has been employed successfully with many crops, notably vegetables, small fruits, and lucerne. With sugar-cane it has received only scant attention, although quite an extensive system was seen on one of the plantations of Hawaii ten years ago, when experiments were also being conducted at the Waipio Sub-station of the Hawaiian Sugar Planters' Experiment Station. The chief drawbacks to the wider employment of the system were (1) the cost of the installation, (2) the faulty distribution of water due to inherent imperfections in sprinkler design and interference from wind.

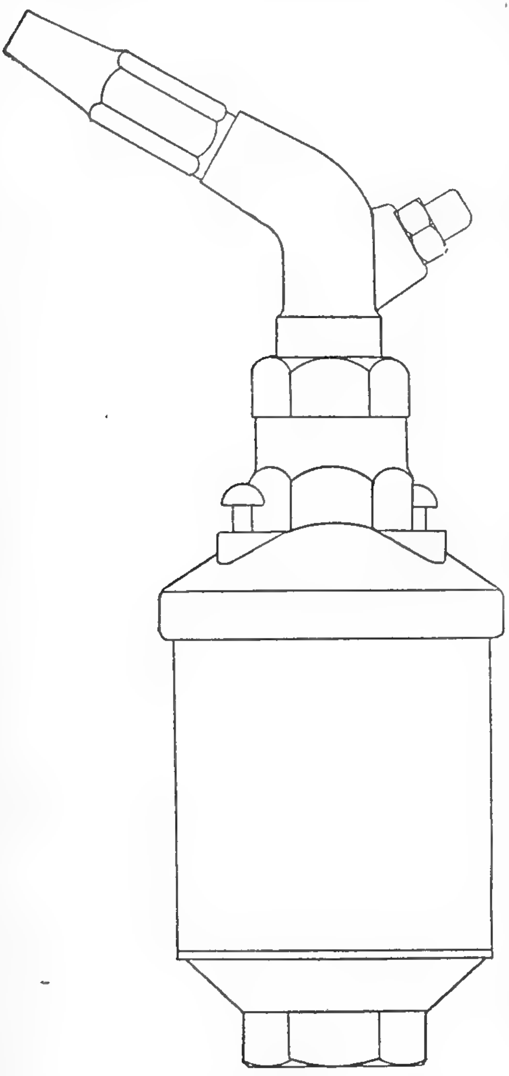


Plate 87.
Illustrating the high-coverage irrigation sprinkler.

At about that time the Thompson Manufacturing Company of California became interested in the problem, and devoted attention to the possibility of supplying a satisfactory sprinkler of wide coverage, so as to reduce the amount of pipe line required. The reduction in the number of sprinklers per acre demanded, of course, increased nozzle size and operating pressure to enable a given amount of water to be applied in reasonable time. The first model developed (Plate 87) was partially successful, and the number of sprinklers per acre was reduced to less than nine. More recently, a further improvement in design has permitted the production of sprinklers with the following characteristics:—

	Sprinkler (*a*).	Sprinkler (*b*).
Diameter of nozzle	$\frac{3}{8}$-inch ..	7/16-inch
Discharge of sprinkler ..	29 G.P.M. ..	42 G.P.M.
Nozzle pressure	45 lb. ..	60 lb.
Sprinklers per acre	3·0 ..	2.37

The greatly improved coverage provided by this system allows of big reduction in the amount of piping required, although this is,

* Reprinted from the "Cane Growers' Quarterly" by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

naturally, of larger diameter. At the same time it permits of the pipe line being laid on the land surface without seriously interfering with cultivating operations.

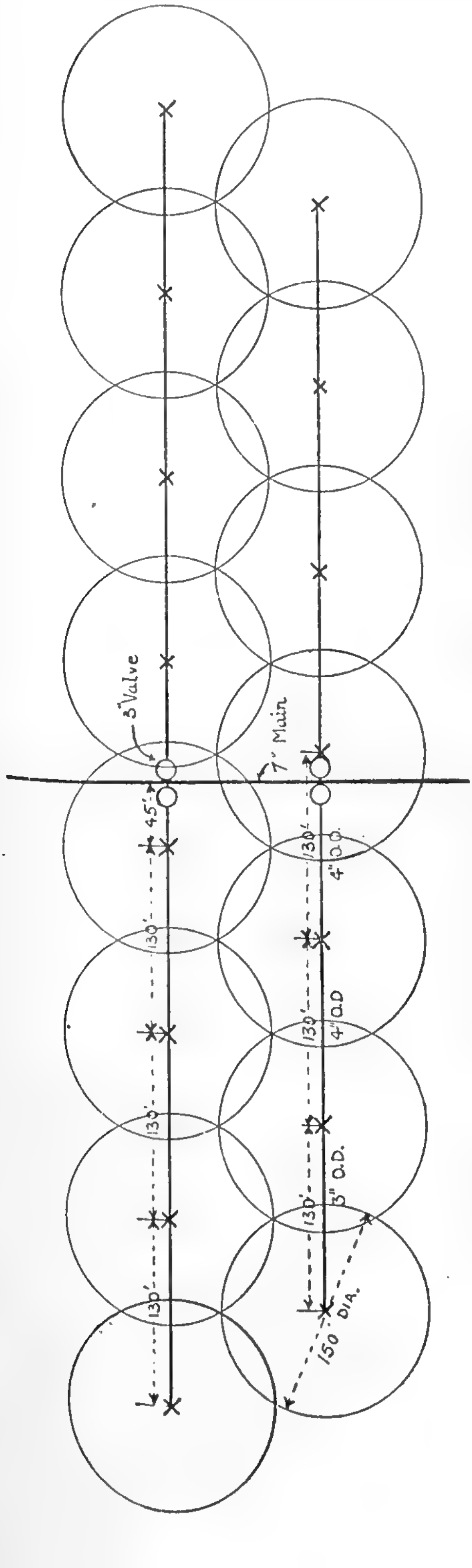


Plate 88.—Illustrating the Arrangement of Pipe-lines and Sprinklers for a 5-acre Unit.

The Sprinkler.

The construction of the sprinkler is such as to ensure positive action; that is, the slow speed at which the nozzle must revolve is achieved by a small water wheel placed horizontally in the base of the sprinkler, which is operated at a high speed by the large volume of water which passes it. By means of a series of gears, packed in a watertight case filled with grease, the positive drive is transmitted to the nozzle through a reduction of 3,750 to one. The nozzle then revolves once in two minutes, and there is but slight danger of failure.

The sprinkler is provided with two jets—the smaller delivers a fan-like spray, which covers a circle adjacent to the standpipe; the larger takes care of a wide ring surrounding this circle. Together these provide a coverage over a circle 150 feet in diameter in the case of sprinkler (*a*), when set on a standpipe 30 feet high. This installation was designed essentially for banana plantations, and for cane growing the height of the standpipe would probably be reduced to 18 to 24 feet, depending on the habit of growth of the variety; a reduction in height would, of course, substantially affect the coverage.

The Installation.

Plate 88 supplies the essential data for one unit of a large installation employing sprinklers of $\frac{3}{8}$-inch nozzle diameter. This unit is 5 acres in extent, and all sprinklers are operated simultaneously.

The pipe consists of black steel piping with outside diameters (O.D.) as shown; it is specially bevelled for welding in the field. Welding results in a reduced installation cost, but increases the difficulty of moving the pipe line later. The standpipes (Plate 89) consist of 10 feet of 2 inch, 10 feet of 1½ inch, and 10 feet of 1¼-inch piping screwed together. The following are the costs supplied by the American Company:—

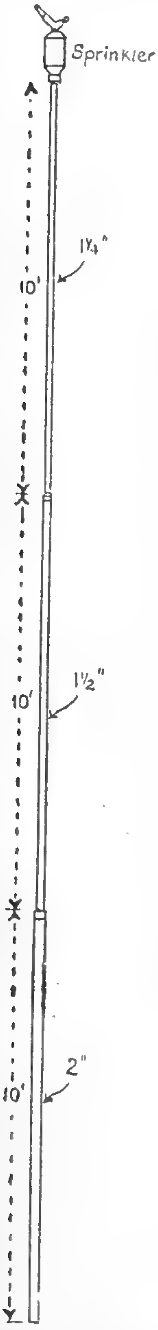


Plate 89.—Illustrating the Standpipe and Sprinkler Set-up.

			$	$
Plain steel pipe 7 in. O.D.,	220 ft.	@	0·72	158·40
Plain steel pipe 4 in. O.D.,	1,170 ft.	@	·27	315·90
Plain steel pipe 3 in. O.D.,	520 ft.	@	·18	93·60
Screwed stand pipe 2 in.	150 ft.	@	·19	28·50
Screwed stand pipe 1½ in.	150 ft.	@	·14	21·00
Screwed stand pipe 1¼ in.	150 ft.	@	·12	18·00
15 super rotor sprinklers		@	10·40	156·00
4 3-in. iron clamp gate valves		@	9·20	36·80
Material for 5-acre unit			=	828·20
1 acre			=	$165·64

Allowing $4·00 as equal to £1 Australian currency, the cost of the material for this installation on the above values would be about £41 10s. per acre. To this must be added the cost of installing a suitable pump and engine. A two-stage centrifugal pump will be necessary to provide the high nozzle pressure required, and take care of friction losses in the pipe line. These have been estimated as follows:—

	lb.
Nozzle pressure	45
Loss of head in lateral	6
Loss of head in elevation of sprinkler ..	13
Loss of head in standpipe	2
Loss of head in 2,000-ft. main	17
Minimum pressure at pump ..	83

Provision must be made also for the suction and delivery head involved in raising the water from the spear or well to the land surface. On the above figures it is estimated that an engine of 40-h.p. would be necessary, operating a 5-inch pump.

With fifteen sprays working at the same time and delivering ¼-inch per hour, a 3-inch watering will be completed in twelve hours. From these figures it may be calculated that 429 sprinklers will water 143 acres in fourteen days if the unit be operated twenty-four hours per day.

With a similar installation employing the nozzles of 7/16-inch diameter, a 70-h.p. motor will enable 429 sprinklers to water 181 acres in fourteen days (twenty-four hours' operation). The cost of the pipe line installation would be practically the same as the alternative scheme described.

Unit Installed at Ayr.

During the past year a small spray system employing these imported sprinklers was laid out at Ayr. Although one object of the layout was to determine the practicability of spray irrigation, it should be made quite clear that the main purpose was the provision of a scheme which would permit of accurately controlled water application for irrigation experimental work, which it is hoped may be carried out at this centre.

Through the courtesy of Messrs. Landa and Co., an area of about 3 acres of land was made available for our use. A well was sunk, and a $2\frac{1}{2}$-inch two-stage pump, operated by a 15-h.p. electric motor, was supplied from a 6-inch slotted brass spear. A 3-inch diameter galvanised pipe line (Plate 90) carried the water to the edge of the field, where the

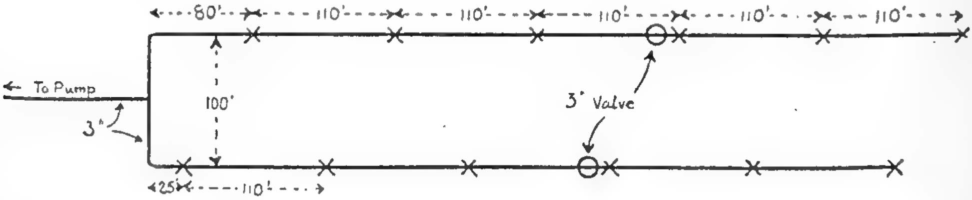


Plate 90.—Plan of the Pipe-line System installed at Ayr for Experimental Purposes.

line was divided into two branches, each carrying six sprinklers. As the standpipes were reduced to 18 feet in length, the distance between sprinklers was fixed at 110 feet, with 100 feet between the pipe lines. This installation was capable of operating three sprinklers simultaneously. With this arrangement it required three hours to apply 1 acre-inch of water.

Our first experiment was designed to determine the effect of the amount of irrigation water applied at each watering. One-half of the area received 2 acre-inches, and the other 3 acre-inches. The intervals between applications varied with the season of the year—from three weeks in the cooler months of slow growth, to nine days in the months of December, January, and February—the season of vigorous growth.

The spring and early summer months were unusually hot and dry, even for this district, and it was early evident that, under these conditions, the 3-inch application was much superior to the 2-inch watering. The full details of the experiment will, however, be deferred until the crop is harvested.

It was found that wind interfered seriously with the evenness of water distribution, and for experimental purposes it was found necessary to conduct the watering during the night hours. Under still atmospheric conditions, measurements made with a series of tin cans spaced over the field showed that the distribution was quite good. For a 3-inch application, for example, the measurements ranged from $2\frac{3}{4}$ inches to $3\frac{1}{4}$ inches. In spite of the dryness of the season, little in the nature of dry spots could be detected in the crop growth, which could not be explained by visible soil variations.

Advantages and Disadvantages of the System.

The following summarises the main advantages and drawbacks of spray irrigation:—

Advantages.

(1) Economy in water utilization due to evenness of distribution of even light applications.

(2) Complete elimination of seepage losses from drains.

(3) Reduction in water distribution costs with respect to (*a*) labour in watering, (*b*) labour and implements in forming water-furrows.

(4) Flat cultivation is possible and an increased number of ratoon crops should be profitable.

(5) Trash conservation may be practised with ease.

(6) Fire protection, as sprinklers may be operated to control accidental burning.

Disadvantages.

(1) High cost of installation. On figures supplied recently by a Brisbane firm, threaded black steel tubing similar to that specified would cost about £39 per acre, to which should be added the cost of sprinklers. The cost per acre could be reduced somewhat if the sprinklers were transferred from field to field as required. It is estimated that the steel pipe line, if laid on the surface of the soil, should have an average life-time of twenty-five years.

(2) High pressures, necessitating an increase in engine power over that normally employed. This would be partially or possibly completely off-set by the reduced volume of water required, with even distribution and elimination of seepage losses.

(3) Moving of pipe line when ploughing. This could be eliminated almost entirely if the main were buried to a depth of 12 to 15 inches, and ploughing confined to the area between surface laterals.

Conclusion.

The results obtained from the trial plot installed by the Bureau at Ayr should, in the course of two or three years, supply data which will permit of a true estimate of the value of spray irrigation. The financial outlay must, however, always remain a serious obstacle to its extensive adoption.

SULPHATE OF AMMONIA—DOES IT EVAPORATE?

This is a question which we are repeatedly asked, despite a detailed discussion of the point in an earlier issue. We would repeat that it may be applied quite safely in dry weather, and it will be taken into the soil by the first rains or even by the dew.

Further, it is not necessary to throw the material into the stool. It is much simpler and just as good to apply alongside the stool; and one-side application is just as good as uniform distribution on both.

H.W.K. in the "Cane Growers' Quarterly."

Alternative Crops for the Canegrower.

H. W. KERR.*

THE canegrower is constantly reminded of the dangers which beset the farmer who is entirely reliant on one crop for his livelihood. At the present time excess sugar production, which results in the disposal of a large proportion of the crop at a value below production costs, renders it more important than ever to seek for alternative crops, for which there exists a ready market, and thus relieve the pressure which at present threatens the existence of many of our growers.

Another aspect of this problem is one which affects the future of Queensland agriculture in its broadest sense. Doubtless the arable lands of our coastal plain must ever constitute the most valuable agricultural areas of the State, and the future of primary production in Queensland appears bound up in the intensive development of this limited tract. Despite popular supposition to the contrary, the major proportion of these good-quality lands has already been brought under cultivation, while the best of these are devoted at the present time to cane culture. The value of intensification of production in reducing unit costs in a country which demands a living wage for its workers, has been repeatedly demonstrated; and a broad review of the question along these lines suggests a solution of the canegrowers' problem, while providing a brighter outlook for the general agriculture of the State.

Due to the uncertainty of rainfall incidence, even in parts of this comparatively humid coastal plain, intensive methods cannot be initiated successfully without the aid of irrigation. What can be achieved where adequate water is available is exemplified by recent developments on the large sugar plantations of Southern Queensland; and results have demonstrated that while assuring the desired crop, production costs are also reduced. By the full development of all available irrigation resources in these districts, similar results could be achieved on substantial areas of the coast. Production control could then be effected with safety and certainty, and it is reasonable to predict that with the assistance of irrigation, the acreage now devoted to cane on such areas could be more than halved, with no reduction in crop harvest. The release of this area of good-quality land for alternative crops, also by irrigated methods, would serve to provide the outlet for an increased farming population, and the relegation of marginal lands to their true position in the economic scheme.

As an illustration of how such a project could be brought into operation, we might consider the red volcanic soils of the Woongarra area, Bundaberg. Some few years ago, serious consideration was given by the growers of that district to the development of an ambitious irrigation scheme, whereby water from the Burnett River would be diverted to this area. As is general with all large irrigation schemes, the initial installation cost would be high, though it was estimated that water could be delivered to all farms in the benefited area for approximately £5 per 1,000,000 gallons. The proposal was finally rejected on

* Reprinted from the "Cane Growers' Quarterly" by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

the grounds that intensification of cane production would but lead to further embarrassment, as the average crop production under natural rainfall conditions is sufficient to supply "peak" crops to the local mills. Apparently, little or no consideration was given to the possibilities of other crops.

At this time, a small irrigation plant was installed at the Bundaberg Experiment Station, for the purpose of studying irrigation problems on the red volcanic soil, and allowing us to gather information regarding the possibilities of intensive production on this valuable soil type, of which the chief drawback is its low water-holding capacity and droughtiness. Our cane experimental plots have already demonstrated the true potentialities of the land, when the natural soil moisture deficiency is overcome, and no difficulty is experienced in the economical production of a 60 or 70-ton crop of cane in sixteen months.

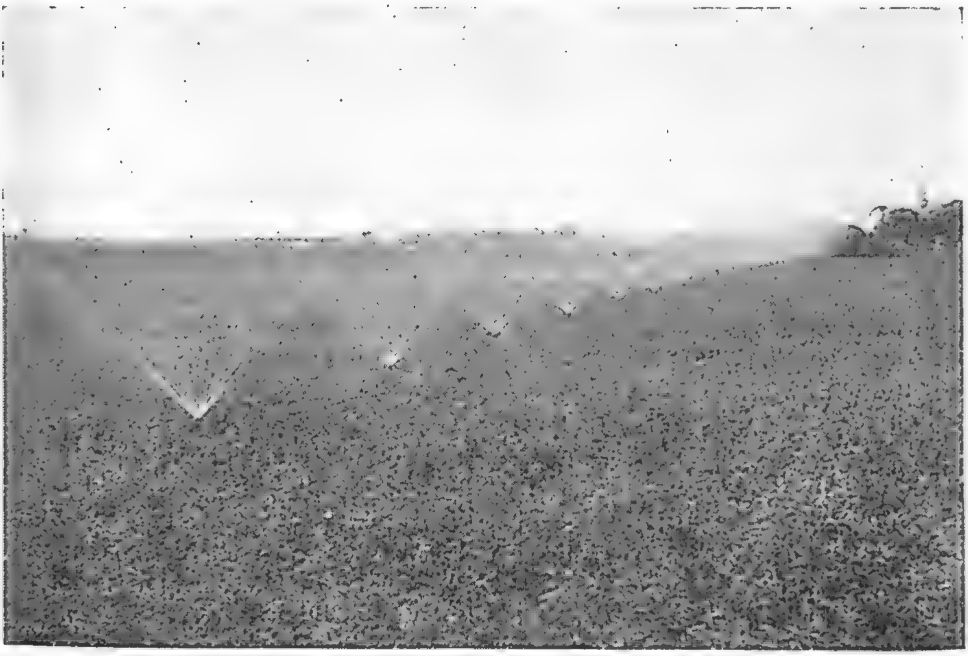


Plate 91.

Operation of the spray system recently installed for the irrigation of lucerne.

Attention was then turned to the possibilities of lucerne production, by watering. For years a lucerne block had been maintained on the station under dry land conditions, and we were generally well supplied with hay for our station horses; but by the use of a spray irrigation system (see Plate 91) some very interesting results were recorded during the past year. The old block was ploughed out, and after thorough preparation, was reseeded in April, 1935. A good stand resulted, and the first cut was made in August. This was allowed to lie on the field. Thereafter the block was irrigated as frequently as required, and cut

whenever the crop had attained the desired growth stage. The following table summarises the history of the field for the year:—

Irrigated.	Crop Harvested.
	1. October 2nd, 1935.
1. November 13th, 1935	
2. November 26th, 1935	
3. December 8th, 1935	
	2. December 16th, 1935.
	3. January 28th, 1936.
4. February 3rd, 1936	
	4. Half February 18th, 1936. Half March 11th, 1936.
	5. Half April 6th, 1936. Half April 14th, 1936.
	6. Half April 14th, 1936. Half May 18th, 1936.
5. May 28th, 1936	
6. July 17th, 1936	
	7. Half July 29th, 1936.
7. August 7th, 1936	
	Half August 19th, 1936.

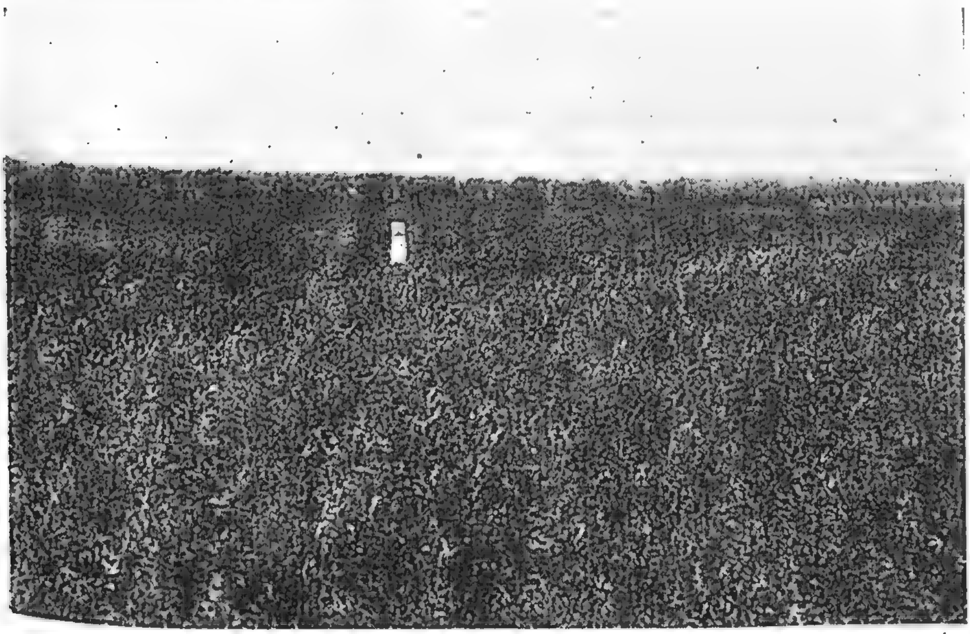


Plate 92.
A fine stand of lucerne on the Bundaberg Station.

In the first year of the stand it was therefore possible to harvest seven cuttings of lucerne, while seven waterings, each of 3 acre-inches, were given. It will be remembered also, that the past season was notable for its rainfall deficiency. Yield determination showed that somewhat more than 2 tons of *hay* per acre were obtained at each cutting, or a total of 15 tons per acre for the year. It should be pointed out that at no time was an attempt made to force growth to its limit, due to the superabundance of hay on hand, at all times, for horse feed. It is the opinion of Mr. N. J. King, who is in charge of this project, that no difficulty will be experienced in the coming year in producing 20 tons of hay per acre.

Plate 93.
Windrowing with the side-delivery rake.

The method of handling the crop is illustrated in Plates 93 and 94. The cost of handling the hay is substantially reduced by the employment of the side delivery rake in windrowing. Though the implement has also proven useful in cocking, it is found that this operation is best effected by hand.

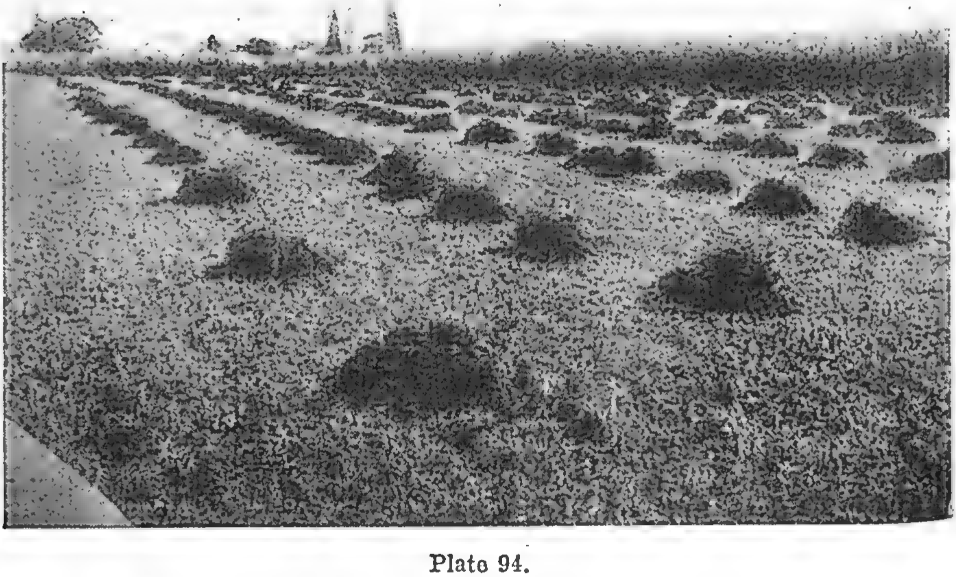


Plate 94.
The cured hay ready for transfer to the barn.

One must conclude, from the above results, that the red volcanic loam of the area is a first-class lucerne soil under irrigated conditions. At average market values for the hay, the gross return per acre would be in excess of £100 per annum, while in the absence of a market for the quantity of hay which might be produced, the development of a stock-fattening industry offers considerable promise.

The production of fat lambs, for example, is an industry for which a ready market is assured, both in Queensland and overseas. It is, therefore, of interest to examine the prospects which such a project would offer, when combined with canegrowing. For it provides a ready means of disposing of crop refuse (green tops), and a mill by-product (molasses) in a much more economical manner than it at present possible on a wide scale. It is suggested that the production of cross-bred lambs, by mating, say, a Dorset Horn ram with Merino ewes, would be productive of the best results under these conditions. The ration for the breeding ewes would be substantially lucerne hay, supplemented by cane tops (when available) or grass for roughage, and with the addition of molasses to supply any deficiency in carbohydrates. The lambs would be fattened rapidly on a similar ration, and marketed at the age of four-five months, when they should yield a dressed weight of from 30-32 lb. On dry land such as this, foot trouble and coastal parasites should be at a minimum, while with small flocks it would be practicable to deal readily with any complications from these causes. Should it be found undesirable to retain the ewes for more than a limited period, both ewes and lambs could be fattened and marketed.

In considering the cost and returns from such a scheme, the cost of labour has not been considered in detail. Doubtless, this would vary with the handling facilities available; but the following estimates of out-of-pocket expenses are presented to indicate the margin which the project offers. Costs are calculated on the basis of 100 ewes, producing eighty lambs.

Feeding costs.

Allowing 750 lb. lucerne hay per ewe per annum—

One hundred ewes will require 34 tons of hay; supplemented by 50 tons of cane tops, &c., as roughage, which would be yielded by 200 tons of well-grown cane.

Adding molasses to the above at the rate of ½ lb. per day, 8 tons of molasses would be required.

Allowing an average of 1 lb. lucerne hay per lamb per day, for four months—

Eighty lambs will require 4½ tons hay.

A molasses ration of ⅓ lb. per head per day, would consume 1½ tons molasses.

Summary.

	Tons.
Total lucerne hay	38½
Total cane tops, &c.	50
Total molasses	9½

Allowing £6 as the cost of 1,000,000 gallons of irrigation water, one half million would be used per acre per annum, at a cost of £3. On the basis of the lucerne yields suggested above, 2 acres would be necessary to supply the required hay. The cost of water would then be £6 per annum. For molasses, a value of £1 per ton, on the farm, might be allowed.

Summary of Above Costs.

Lucerne irrigation	£6
Molasses purchased	10
Fertilizer for lucerne block	5
	£21

Cost of marketing must also be added.

Return from Ewes and Lambs.

Eighty lambs at 20s. each	£80
Wool from 100 ewes at 8s.	40
Profit, from sale of fat sheep, at 4s. per head	20
	£140

In addition to any income which would be derived from this source, it must be borne in mind that the utilization of cane tops and molasses as feed would result in the economic disposal of these by-products, while the droppings voided by the animals would contain a large proportion of the plant-food materials contained in the feed, and would constitute a valuable manure for the cane lands.

It should be emphasised that the above suggestions are presented, not as a cure for the ills of excess sugar production, but merely as a line of thought which should interest those of our growers who are earnestly seeking some way out of our present difficulties. Moreover, while such schemes might be of value in the drier cane areas, the problem of the humid north offers greater difficulties.

CROWN LAND FOR GRAZING HOMESTEAD SELECTION.

CUNNAMULLA DISTRICT.

The resumption from Cunnamulla Holding has been surveyed as portion 4, parish of Eunama, and is situated about twelve miles southerly from Cunnamulla.

It will be open for Grazing Homestead Selection at the Land Office, Cunnamulla, on Monday, 12th April, 1937, at 11 a.m.

The selection will be for a term of twenty-eight years, and the annual rent for the first period of seven years is 2¾d. per acre.

The selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years.

The portion is good wool-growing country, and is well watered by four bore drains.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agent, Cunnamulla, and the Government Tourist Bureaux, Sydney and Melbourne.

Soil Erosion.

H. W. KERR.*

DURING recent months the subject of soil erosion has been given considerable prominence in agricultural discussions. Doubtless, it is one of the most serious agricultural problems with which a country is faced, and it is of national importance. It is, at the same time, one which is conveniently ignored by those who are most adversely affected by it, and the realization of its nature is truly appreciated only when the damage has been done. As with most other problems, methods of prevention are always simpler than cures. Since the question of soil erosion is a matter of decided importance to some of our valuable cane-growing areas, it would appear fitting to place before cane farmers a few observations on—(1) its causes, (2) its prevention, and (3) its cure.

The Causes of Erosion.

The term "erosion" means the loosening and removal of soil from its previous resting place, through the agency of wind or water. Insofar as the Queensland cane areas are concerned, the action of wind is of minor importance, and we will therefore confine our attention to water erosion. When rain falls on the land surface, a proportion is absorbed by the soil, while the balance flows away and ultimately finds its way to a neighbouring watercourse. Flowing water possesses the power of carrying with it a greater or less amount of solid matter, gathered from the surface over which it flows. The gradual removal of soil in this way, insignificant though it may appear in some circumstances, is one of the most potent forces in converting valuable land—and notably land of appreciable slope—to a state of low productivity. Water which percolates through the soil carries with it valuable plantfood materials which it dissolves. To replace these, the application of simple and appropriate fertilizers is sufficient treatment. But the removal of the solid soil particles by surface "run-off" water is something which cannot be so readily restored. It is common experience that the finest particles of the soil are those most readily removed in this way, and these materials also constitute the most fertile portions of the land. When a river carrying such sediments overflows its bank, its speed is checked and the suspended matter is deposited on the flood plain in the form of sediments, which eventually provide characteristically fertile alluvial soils.

The major factors affecting the intensity of erosion are—(*a*) Type of soil, (*b*) slope of the land, (*c*) farm management methods, (*d*) amount and rate of rainfall.

(*a*) Sandy soils are, in general, least subject to erosion, since they are capable of rapid absorption of water. But should conditions result in the creation of a fully-saturated sandy soil, the absence of binding material permits it to be carried down a slope at a very rapid rate; again, the coarseness of the particles may cause it to be deposited before it has travelled any great distance.

Heavy clay soils are more subject to gradual wearing down by water, but the strong cohesive forces which exist in such soils offers great resistance to loosening.

* Reprinted from the "Cane Growers' Quarterly" by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

The soils most liable to erosion are the intermediate class known as loams. When saturated with water they may move off in large masses due to their plastic nature. A loam rich in organic matter possesses advantages over those not so favoured, for this important soil constituent promotes more complete water absorption, while acting also as a mechanical obstruction due to its fibrous character. Unfortunately, few cane soils could be classed as rich in humus.

The presence of gravel and stones is sometimes helpful in preventing erosion, as they are themselves moved with difficulty; they also offer resistance to the free flow of water, and definitely protect the soil which lies beneath them.

(*b*) The steepness or "gradient" of the land has a very direct and obvious influence on the degree of erosion experienced. While silts are removed even by water flowing over relatively level land, the carrying capacity of flowing water increases at a very rapid rate with increased slope. This is very apparent when we study the rate of gully formation in a field. A series of measurements which were made to determine the influence of slope showed that, while 8,000 lb. of soil were removed annually from an acre of "level" soil, the rate of removal was doubled where the gradient was 1 per cent., and trebled where the slope was between 2 and 3 per cent. Steep slopes also affect the relative amounts of moisture absorbed and shed by the land.

(*c*) The nature of the surface of the soil is one of the greatest factors in determining the extent of erosion, and is indeed one of the major considerations in devising control measures. Soils in their natural condition possess a protective covering of forest, scrub, or natural grass, which prevents erosion on all but the steepest slopes. The removal of the vegetative cover, and particularly the subsequent tillage operations to which the land is subjected, results in a drastic disturbance of these natural conditions, and erosive factors are given full play. A loose layer of surface soil—particularly when underlain by a subsoil hardpan created by tillage implements—presents an ideal medium for the absorption of the first rains which fall, at least to the point where it becomes saturated. Should deep percolation of the excess moisture be hindered in some way, it requires little further water to cause the plastic surface layer to move down a slope, should this condition exist. The adverse influence of even surface tillage implements is readily seen on a tilled hillside field following heavy rains. The removal of the surface mulch layer reveals the tracks of the individual tynes of even the homely scarifier.

(*d*) It is readily evident that the rainfall rate is one of the potent factors in erosion. Heavy and rapid downpours inevitably cause greater removal of soil than an equal amount of rain falling over a longer period. This is due to the time factor which is involved in the moisture absorption rate for any soil, and the soil removal influence is thus bound up in the amount of run-off water. The state of the soil at the time a heavy downpour is experienced—whether it be relatively dry or already water saturated—is an important consideration. Heavy rains themselves beat and compact the surface soil layer and destroy in some degree the natural absorptive capacity of the land. In the coastal regions of Queensland, with their recurrent tropical deluges, the effects of erosion are widely evident even on relatively gentle slopes.

The character of the crop to which the land is devoted has a very marked bearing on the degree of erosion experienced. The following series of figures obtained from studies conducted in the middle west of the United States of America is very interesting in this connection:—

Soil Treatment.	Percentage of rainfall which ran off.	Total weight of soil removed per acre per year.
	Per Cent.	Tons.
Not cultivated	49	30
Ploughed 4″ deep	31	36
Ploughed 8″ deep	28	31
Grass sod	12	¼
Wheat each year	25	6
Maize each year	27	16

The slope of the land was slightly less than 4 per cent., and the annual rainfall varied from 24 to 50 inches over the duration of the experiment (6 years). Certain features of these results are worthy of note. Firstly, erosion was greatest on the loose, ploughed soil without crop. Secondly, the presence of a growing crop reduced the loss, and this influence was greatest with the crop which afforded the most complete cover. Maize—which might be compared with sugar-cane in this regard—reduced the erosion loss by one-half, wheat effected a reduction of five-sixths, while with grass sod an insignificant amount (¼ ton) of soil was carried away. In passing, attention should also be drawn to the loss of water due to run-off which occurred under the various systems of husbandry. The rate of soil removal on a well-tilled slope is commonly evidenced in our Queensland cane areas, when a deluge of rain is experienced during the planting season. How often the farmer awakes to find his soil and plants washed down to the low end of the block!

The Prevention of Erosion.

From the preceding discussion it may be concluded that soil erosion is caused by water running from higher to lower levels over the surface of the ground. Erosion control therefore consists in decreasing or diverting the run-off, or both. The possible methods are—

(1) Reducing the run-off by making the soil more readily absorbent.

(2) Keeping the soil covered; a good vegetative cover also slows down the run-off and causes more water to be absorbed.

(3) Holding and diverting the water along courses having such a gradient that the erosion damage is negligible. This principle is employed in terracing.

(4) Conveyance of water from higher to lower levels in artificial channels. This principle is generally applied in disposing of concentrated run-off from fields, and in checking deep gullying.

These several preventive methods will be discussed in some detail.

1. The absorptive capacity of the soil may be improved by sub-drainage. The growth of deep-rooted crops—*e.g.*, lucerne—will open up stiff soils and provide channels through which the water may pass. Deep ploughing and subsoiling or grubbing will also assist in increasing absorption. In ploughing on slopes, the furrow slice should always be thrown up-hill, by the use of a reversible hillside plough. Land left in this condition will always absorb more water than where the furrow slices are thrown down-hill. Contour ploughing is obviously better than ploughing up and down the slope for similar reasons. All methods of humus restoration are to be encouraged, slow though the process may be; a soil rich in organic matter will remain open and make for more complete rainfall absorption.

2. Unfortunately, the canegrower has little opportunity for keeping his land covered. Where crop rotation is the vogue, the farmer may keep his land under grass cover for a proportion of the rotation period; and the steeper the slope of the land the greater the proportion of the rotation during which grass cover should be kept. The canegrower has, however, two opportunities of doing something in this regard; during the fallow, a green manure crop should invariably be sown; where serious erosion losses are encountered, trash should *never* be burned but left on the land surface to serve as a mulch. The benefits of trash conservation are twofold—(*a*) the avoidance of ratoon cultivation leaves the soil undisturbed and reduces the rate of subsurface packing; (*b*) excess water is shed by the trash layer instead of by the loose soil, and, therefore, a sediment-free run-off replaces the normal sediment-laden stream. On certain farms in the humid northern cane districts, this practice is being employed systematically with very good results. Relieving of the trash from the stools promotes a more rapid ratooning, and facilitates the application of both mixed fertilizer and sulphate of ammonia.

Experience shows that land of greater slope than 5 per cent. should never be devoted to cultivated crops continuously; where the slope reaches 10 per cent. cultivated crops should occupy the land only during a small fraction of the rotation period, while land of more than 15 per cent. slope should be kept in permanent pasture. From these data it is evident that much land which is being cultivated at the present time will be *completely useless* in a few years. Unfortunately, no means are available whereby the farmer may be obliged to devote his land to those crops for which it is suited, and thus avoid the national calamity of denuded hillsides of waste land.

3. Where the methods hitherto discussed are not adequate or suitable for the purpose of effecting erosion control, the farmer must resort to terracing his land. Such a suggestion is generally dismissed by the farmer as something both costly to carry out and difficult to deal with. A careful study of the accompanying notes will show, on the contrary, that terracing may be effected at very little cost, while its presence is scarcely noticed during subsequent cultural operations.

The terrace is a flat ridge of earth like a steeply-graded road or an extra large back-furrow, from 15 to 20 feet wide at the base, and built almost on contour lines around the slope. Above this ridge is a flat, broad channel. The crest of the terrace is 15 to 24 inches above the bottom of this channel. Terraces control the run-off, because they are spaced in a series like steps down the slope, each taking its share of water before the total quantity becomes large enough to do damage. The water which each traps is carried in a broad slow-moving stream to the side of the slope without damage to the field. This slow movement keeps the water in the field for a longer time, causing more of it to be absorbed into the land, and reducing run-off and loss of soil by erosion. Reference to the accompanying sketch (Plate 95) together with a detailed description of the process of terrace construction should make these points clear.

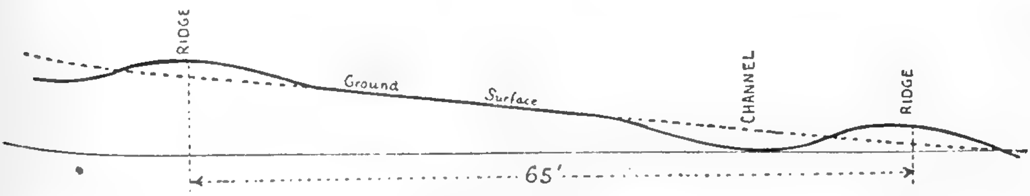


Plate 95.

Showing the cross section of a terrace on a slope of 10 per cent. Under these conditions terraces will be formed at intervals of 65 feet down the slope.

Terraces are constructed in such a direction across the slope of the land that they provide a fall of not more than 6 inches in 100 feet. They are spaced so that each will take care of the water which falls between it and the one above; they must be close enough together so that the run-off water from average storms will not have an opportunity to descend in small rivulets between the terraces. Where the slope is slight, practically all sediment carried to the terrace under abnormal conditions will be deposited immediately. The most suitable distance between terraces is governed by the slope of the land and the soil type. As a rule, there should be a vertical fall of from 4 to 6 feet between terraces on land with a grade of from 5 to 10 per cent. A greater vertical distance should be allowed where the slope is greater.

The most suitable distance between terraces is shown in the following table:—

Slope of Land.	Vertical Drop between Terraces.		Distance between Terraces along Slope.
Per cent.	Feet	inches.	Feet.
3	3	0	100
5	4	3	86
8	6	3	78
12	7	0	58

The gradient along the terrace is also governed by the length of the terrace and the natural slope of the land; the following table offers a useful guide in this respect:—

Length of Terrace.	Gradient per 100 feet along Terrace where Land Slope is.		
	5 Per Cent.	10 Per Cent.	15 Per Cent.
Feet.	Inches.	Inches.	Inches.
0 to 300	½	¾	1
300 to 600	1	1½	2
600 to 900	2	3	4
900 to 1,200	4	6	7
1,200 to 1,500	6	..	..

In staking out the terraces a home-made level is useful (Plate 96). It is constructed in such a way that one leg is shortened or made adjustable, so that the correct fall is obtained when in the "level" position, as shown by the bob or spirit level. Thus if the span be made 16 feet 8 inches six steps will be required per 100 feet of terrace; hence, to strike a fall of 6 inches in 100 feet, one leg should be made 1 inch shorter than the other.

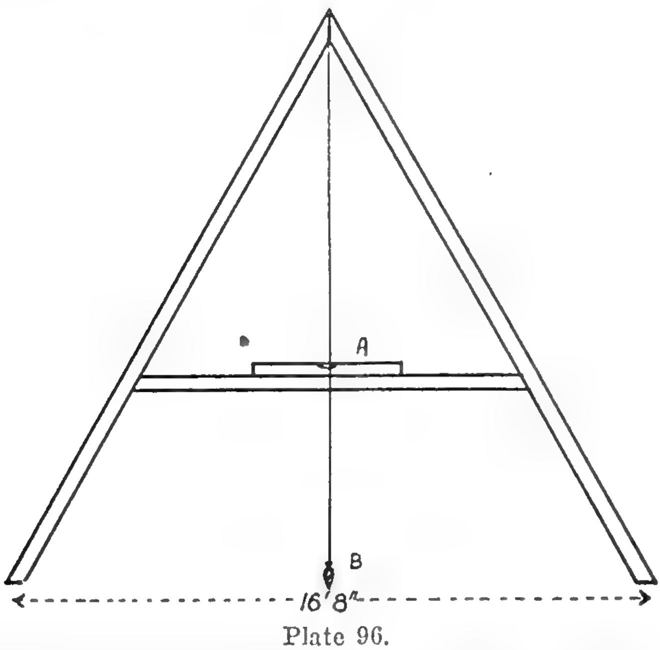


Plate 96.

Illustrating the home-made leveller for use in laying out terraces. Either spirit level (A) or bob (B) may be used.

The first step in the construction of the terraces is to find a suitable outlet for the water which will be discharged at either end of the terrace. A well-sodded pasture is best. Care should be taken that any gully into which the water is discharged is protected against erosion,

using saplings or rocks where necessary (Plate 97), whilst at times earth dams may be necessary. The point at which a terrace crosses an intermediate small gully must be higher and stronger than at other points to eliminate the danger of the water breaking through. The top terrace is made first, and should be built up sufficiently high, so that water from higher up will not collect and break across it before it has settled. An ordinary swing plough may be used to mark out the line of stakes on the terrace; the stakes may then be used in setting out the next one below. It is important to exercise care in laying out the terraces accurately.

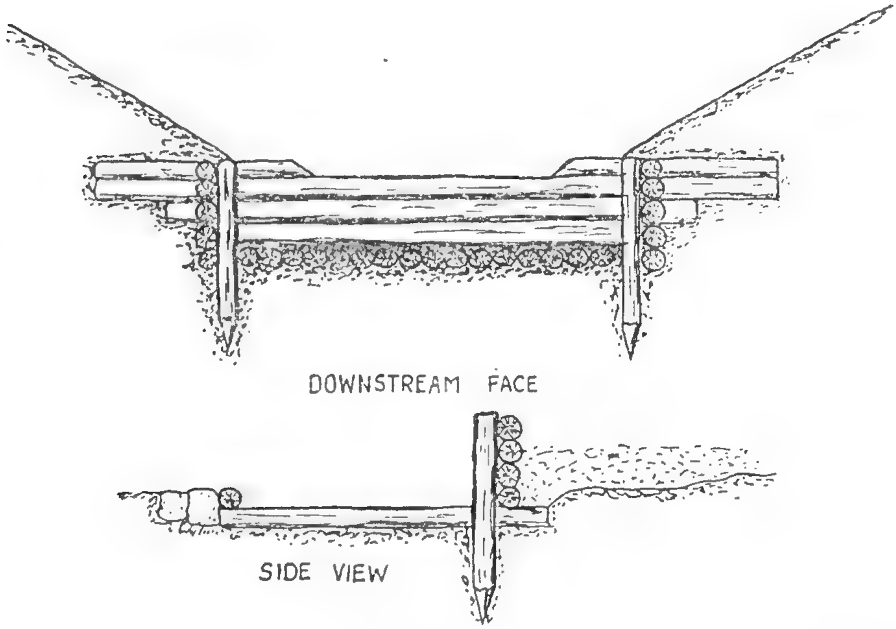


Plate 97.

A suitable type of log dam which may be built across a gully. The apron of timber effectively prevents erosion by the falling water.

The terrace is built up first by means of a team and plough, and later by the use of a light road grader or V-shaped drag. Very little ploughing is necessary in light soils. It is customary to throw together six or eight furrows, and then push the soil towards the centre by means of the grader. This process is continued until the top of the terrace is 12-18 inches higher than the lowest point above the terrace—that is, in the water channel. When completed the terrace should be fairly compacted, and no low points should be left. It is important to build sufficiently highly over low places or small gullies.

During subsequent ploughing and planting operations, the contours should be followed; if the slope is less than 8 per cent., and the terraces are well established, they may be ignored in all cultural operations. When crossing the terrace it is an advantage to plough slightly shallower so that the bank is not weakened early in its lifetime. It is advisable to pay careful attention to the terraces during their first year, so that any break may be repaired as it forms. It is best to throw a little soil on to the terrace when ploughing, and the channel on the upper side of the ridge must be kept clear. For safety sake, the land should first be devoted to grass or to a cover crop of peas or beans to give it the best opportunity to consolidate.

Although terracing has not been exploited in the Queensland cane areas, it is a practice worthy of the closest consideration by growers who are farming high slopes. The cost of the work in the American states is about 10s. per acre, which is certainly not excessive. The farmer should take care that the work is carried out after the risk of heavy rains is past—that is, during the autumn or winter months. The terraces will then have an opportunity of settling down by the late spring, when a cover crop of legumes may be planted to protect the terrace during its first wet season.

Cure of Erosion Damage.

From what has been said it will be apparent that the direct cause of destructive erosion is, on the one hand, soil disturbance, which destroys the binding forces operating under natural conditions, and on the other hand, the force of running water tending to move it. Removal of natural vegetation also tends to increase the quantity of run-off. The formation of gullies may usually be traced to the creation of a direct fall for run-off concentrated at that point. Gully-cutting must be checked by decreasing the fall and cutting power of the water until it becomes negligible. This may be done by diverting the water to a fresh channel, by providing an artificial channel at the fall, or by raising the level of the gully floor by means of soil-saving dams. This reclamation work should commence at the head of the gully, while the lower part can later be reclaimed by additional dams, if the value of the land warrants the cost.

The general removal of soil over a wide expanse of field (sheet erosion) or shallow gullying of fields is primarily the form of erosion attending any form of cultivation. Cultivation removes the roots which naturally bind the soil together, by turning under the layer of surface organic matter which helps markedly in increasing the absorptive power of the soil, by destroying the soil humus through continuous cropping and exposure, and by making the soil loose and friable. The lastnamed also assists in water absorption, but when water begins to run off it hastens the removal of the soil.

The surest method of preventing erosion is to keep the soil continuously covered with vegetation. For steep slopes and poor rocky soils, forest growth is the best and safest plan. For better soils, capable of producing good yields, permanent grass is recommended for moderate slopes with but intermittent planting of cultivated crops. Fertilization of such pastures will assure more luxuriant growth of grass, and hasten the rate of fertility restoration.

Finally, many soil erosion problems are not individual but community concerns, which can only be tackled and solved through the concerted effort of all concerned. This must usually be achieved through the intervention of an independent authority; this course must inevitably follow the full realisation of the seriousness of soil erosion from the national standpoint.

POINTS ON CHOOSING A TRACTOR.

A tractor is distinctly a business investment, and the man who buys one should be very careful to see that it is of the size, power, and type suitable for the work he requires of it. To assure himself on this important point his best plan is to inspect a range of tractors from which a selection can be made of a unit built for working, large, medium, or small farms, for orchard or vineyard work or for whatever kind of property the purchaser is operating. This is the individual problem that confronts every intending tractor buyer; but he will soon be able to settle it with satisfaction to himself if he examines a full range of modern tractors such as International Harvester provides in the McCormick-Deering tractor line.

Some Important Factors in Cane Irrigation.

H. W. KERR.*

IN the October, 1934, number of the Cane Growers' Quarterly Bulletin (page 25) were reported the results of an irrigation trial conducted at the Bundaberg Experiment Station. A small block of P.O.J. 2878 was March-planted and given weekly irrigation treatments until harvested. In order that plant-food deficiencies might be avoided, monthly applications of fertilizer were also made. Under these conditions it was possible to follow the relationship between atmospheric temperature and crop growth. As reported, the plant cane at eighteen months yielded 93·4 tons per acre, with a c.c.s. of 12·1 per cent.; the monthly growth rate was also presented, and the striking differences between these rates for respective months were emphasised.

The block was ratooned and the first ratoon crop harvested in October, 1935, when the cane was twelve months old. This crop gave 72·8 tons of cane per acre, with a c.c.s. of 13·0 per cent.

It is freely admitted that the conditions under which these crops were produced could not be duplicated on a farm scale, and that no grower would in any case find it profitable to produce crops of this magnitude due to the danger of lodging. It is also true, however, that the average return from irrigated cane in Queensland falls far below the values recorded here, even where the water employed in the growth of the crop is comparable in amount. It is therefore proposed to discuss the growth rates recorded from these trials, and see whether it is possible to relate the factors—water used and crop produced—so as to give us a clue to our problem.

Plate 98 is a graphical representation of the monthly growth rates for the first ratoon crop of the trial. These data were calculated from weekly growth measurements made on a large selection of tagged stalks, and the tonnage of cane produced over a given period was calculated from the elongation recorded during that time in relation to the total length of stalk, which is regarded as proportional to the actual tonnage at harvest time. It is appreciated that allowance should be made for variations in the thickness of stalk; but omission of this consideration will not seriously affect the argument.

Due to the excellent growing conditions which were provided the young ratoons made rapid progress and millable cane was showing early in November. The growth rate slackened towards the end of the month, but then increased to its maximum for the season during the early days of January, to be followed by a well-defined check rising to a second maximum early in February. Thereafter the growth rate declined steadily until the beginning of June, when growth was virtually suspended throughout the ensuing three months, despite an abundance of available plant food and soil moisture.

The actual cane production per month (Plate 99), as calculated from the growth measurement records, was more than 18 tons per acre for both January and February, while for the three summer months—December to February—the total crop growth was 49 tons of cane per acre. As this is in itself an accomplishment of which any cane grower would be proud for a full year's growth, it may be well to investigate the factors involved in this phenomenal performance.

* In the "Cane Growers' Quarterly" (reprinted by courtesy of Dr. Kerr, Director of the Bureau of Sugar Experiment Stations).

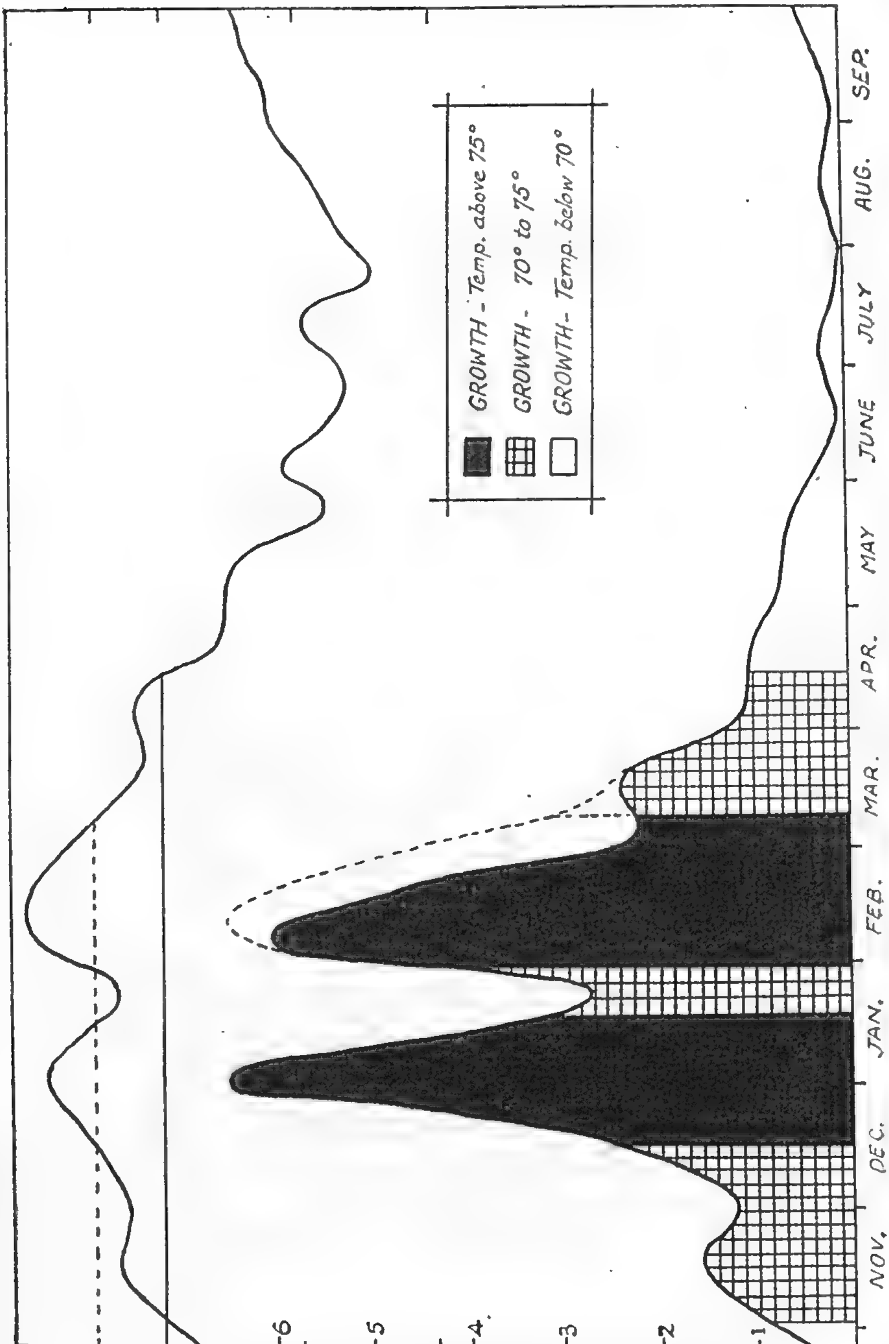


Plate 98.

Graph illustrating the growth rate of a ratoon crop of P.O.J. 2878 at the Bundaberg Experiment Station, 1934-35 season, together with the mean atmospheric temperature curve for the period.

During February trouble was experienced with the irrigation plant, and the dotted portion of the curve suggests the maximum growth rate obtainable.

In Plate 98 is recorded also the mean atmospheric temperature curve. It will be observed that provided soil moisture deficiencies have been eliminated there exists a very close correlation between temperature and growth rate. The following points are clearly demonstrated:—

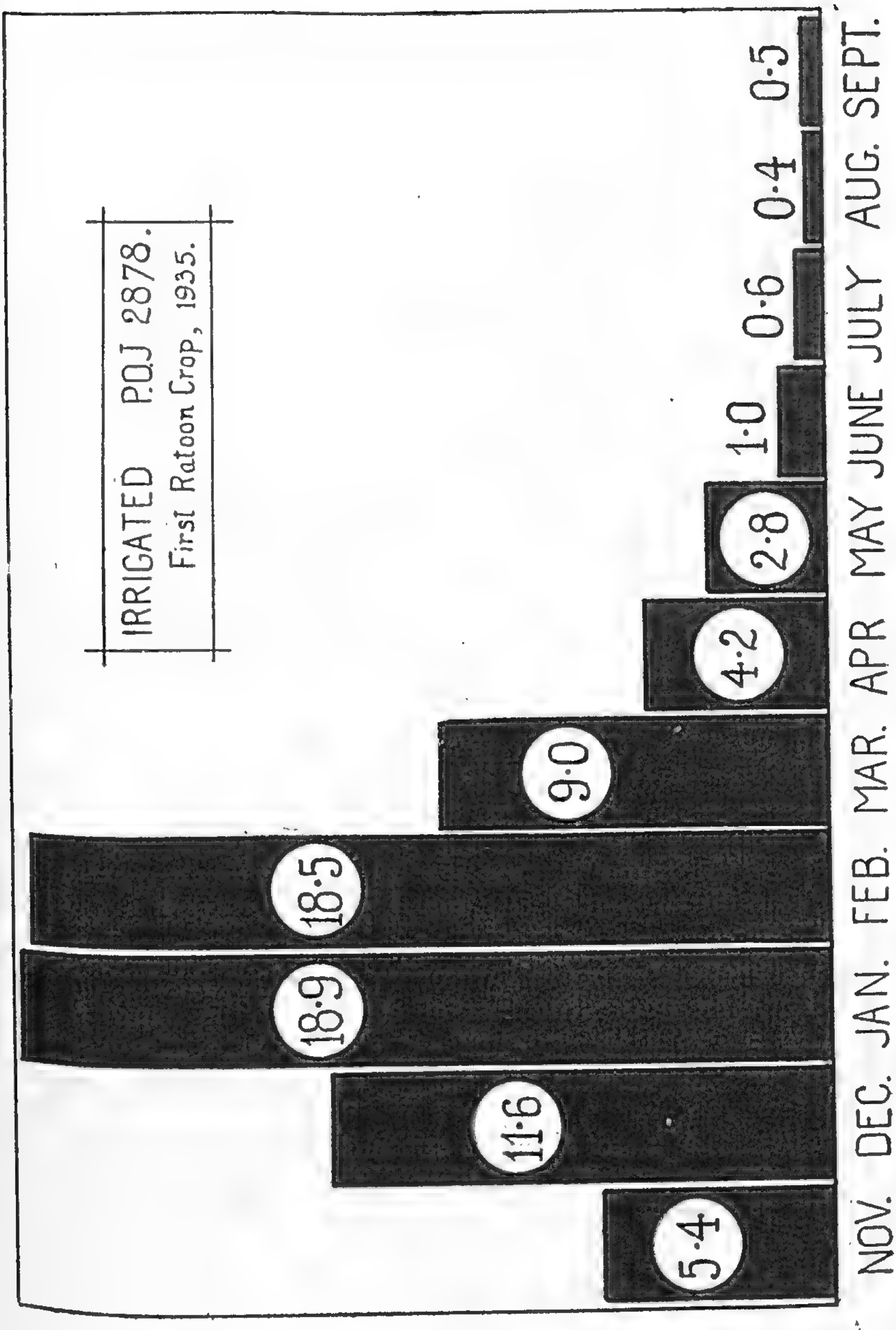


Plate 99.

The blocks represent, by their height, the average monthly growth rates, while the figures in the circles give the actual cane tonnage produced during the month.

(1) Vigorous cane growth commences when the mean temperature rises above 70° F., and declines when it falls below this limit.

(2) Between the limits of mean temperature, 70–75° F., the rate of growth increases at a rapid rate.

(3) When the mean temperature exceeds 75° F., the cane growth rate amounts to more than 6 tons of cane per acre *per week*.

An attempt has been made to bring out these facts more clearly by checking and blocking in those areas of the curve representing the above temperature ranges. It is then observed that the growth check recorded during January was due entirely to a "cool change" in the weather at that time.

The obvious deduction is that for best results from irrigation the farmer must work by the thermometer. So long as the mean daily air temperature lies below 70° F. nothing is gained by excessive watering of the crop; when the seasonal values rise above this figure the cane will make good use of all the soil moisture it can acquire; and when the mean temperature exceeds 75° F. the irrigation plant should be operated day and night for maximum results. In a previous paper on irrigation it was stated that in the production of 1 ton of cane the equivalent of $1\frac{1}{4}$ to $1\frac{1}{2}$ acre-inches of water are absorbed from the soil by the crop and evaporated from the cane leaves. A growth rate of 6 tons of cane per week, therefore, demands from 7 to 9 acre-inches of water per week. In the absence of adequate rainfall the average pumping plant would be fully taxed to supply this quantity of water even when working continuously. Thus, for a grower watering 40 acres of cane, the daily water consumption would be about 40 acre-inches, or 900,000 gallons; this is practically the average output of a 7-inch centrifugal pump operated day and night.

On the evidence presented it is difficult to over-emphasise this point. No quantity of water applied to the particular crop in question after the month of April could possibly induce vigorous cane growth; for the long, warm days were then past and such water as was supplied merely served to maintain the crop in good condition until harvested. The ideal watering system would then be:—

(*a*) Apply sufficient water to the crop during the spring, autumn, and winter months to avoid any check in growth or any distress due to wilting.

(*b*) During the three summer months it is scarcely possible to over-supply the land with moisture under average farming conditions.

Even when beneficial rains fall watering should be resumed almost immediately; for even under the best of conditions the depth of soil drawn on by the crop roots will not hold more than 5 or 6 acre-inches of available moisture—barely a week's supply during the heat of mid-summer.

Such a policy, though doubtless imposing heavy demands on the irrigation plant at this season, would lead in the aggregate to both greater cane tonnages per acre and reduced water consumption.

THE WATER SUPPLY FOR THE DAIRY HERD.

The water supply on many dairy farms is too often a limiting factor in milk production. An abundance of pure, fresh water, is essential for the best results. While not spoken of as a food, it is absolutely necessary for all the processes of nutrition. It is a well-known fact that mastication, digestion, absorption, and assimilation are all impeded by a lack of water. No food can be utilised by the body until it has been brought into solution, and as water is the chief agent in accomplishing this, it will be seen that a good, pure water supply is essential at all times. It is the common carrier of the body, both in the distribution of the nutrients and in the elimination of waste and the various poisonous products through the skin, kidneys, and the digestive tract. Through evaporation from the surface of the body and the lungs it regulates the body temperature. It is, of course, well known that the largest constituent of milk is water, of which it forms about 87 per cent. A shortage of water will cut down a cow's milk flow more quickly than a shortage of feed. The dairyman, in order to maintain a maximum flow of milk, must, in addition to good feeding, provide an ample water supply, as each cow on an average consumes about 12 gallons daily. The quantity consumed depends very largely on the temperature and the milk flow. Cows in milk require three or four times as much water as dry cows. Drinking does not produce milk, but heavy milk production and the heavy eating that results from it induces the consumption of a great quantity of water.—L. VERNEY, Instructor in Dairying.

The Breeding of New Varieties of Sugar-Cane.

ARTHUR F. BELL.*

POSSIBLY no phase of the agriculture of sugar-cane is now receiving as much attention by Experiment Stations as cane breeding, and rightly so. Yield per acre can be improved by various methods, most of which involve the expenditure of considerable sums of money, but once a variety of superior yielding power has been produced it continues to give higher returns per acre with no added outlay.

The cane-breeding programme of the Bureau is now undergoing considerable expansion, and so it was thought that a survey of the aims and methods used might be of some interest at this time. The conditions permitting the expansion of the programme are—

(*a*) The Northern Station has been transferred to Meringa, where the lower rainfall does not interfere so much with the shedding of the pollen of the male parents.

(*b*) The Mackay Station has been transferred to Te Kowai, thus permitting a larger and more representative area to be devoted to seedling raising.

(*c*) A small irrigation plant has been installed at the Bundaberg Station and this will ensure our being certain of raising seedlings under reasonably good conditions in the frequently recurring drought years.

Plate 100.

Showing the diversity in type of "wild" canes which may be used as parents in crosses with "noble" canes in order to introduce desirable characters in commercial canes. (After Venkatraman.)

* In the "Cane Growers' Quarterly," and reprinted by courtesy of the Director, Bureau of Sugar Experiment Stations.

It may be emphasised, however, that such irrigation as is used will not be excessive; over-good or over-bad conditions tend to bring the majority of seedlings to the same level and make selection impossible—our aim is to be certain of having reasonably good conditions.

Sugar-cane breeding dates back only to 1889, when seedlings were raised in both Java and the British West Indies, but it is interesting to note that the Queensland Acclimatisation Society was soon in the field and raised a few seedlings in 1890. This work was continued by the Society on a small scale until 1907, when it was abandoned; Q. 813 and Q. 1098 are the best known of the canes produced by this organisation. From 1901-5 seedling raising was carried out by the C.S.R. Company at their Hambledon Plantation, and here were bred the well-known H.Q. 426 (Clark's Seedling) and H.Q. 285. With the establishment of an Experiment Station within the tropics (South Johnstone) this Bureau was enabled to commence seedling raising in 1921, and S.J.4 is the best known of the early seedlings.

During this period most Sugar Experiment Stations had undertaken the breeding of new varieties of sugar-cane, but in general this work had not met with the success which had been anticipated, and the methods employed had not been greatly improved. Within recent years, however, rapid advances have been made, due in part to the better circulation of knowledge through the conferences of the International Society of Sugar Cane Technologists and the discovery of new species of sugar-cane and their value in breeding. In the early period at South Johnstone we were forced to breed only from the "noble" species, with the result that although many vigorous canes of high sugar content were produced, most of them were too "aristocratic" and could not withstand hard conditions or disease. At the present time we have available five species of sugar-cane, one of which was found by the aeroplane expedition led to New Guinea by Dr. E. W. Brandes in 1928. We have been forced, just as all plant and animal breeders are eventually forced, to go back and reintroduce "wild blood" in order to gain stamina.

Recently attempts have been made to cross sugar-cane with plants other than sugar-cane in the hope of building up crossbreeds which will contain some qualities at present lacking in cane. The most promising of these are the sugar-cane sorghum crosses carried out in India by T. S. Venkatraman, who recently visited Queensland as a delegate to the Congress of the International Society of Sugar Cane Technologists. In India, as in parts of Queensland, early maturing canes are a pressing need; it occurred to Mr. Venkatraman that perhaps the crossing of cane with a short cropping plant, such as sorghum, might bring about this result. The attempted crossing was successful and gave progeny which look more like cane than sorghum and reach maturity in five to six months. Unfortunately, they still lack vigour, although the sugar content is reported to be good. It would appear that by back crossing on to cane for one or two generations there is a fair chance that a cane (or should we say a "sorg-cane"?) will be produced having vigour, high sugar content, and early maturity. Four of these first crosses have been introduced into Queensland and will shortly be taken up to Meringa, where it is hoped that they will arrow and enable Mr. Barke to effect crosses back to cane.

The methods employed in raising seedlings vary considerably in detail according to conditions and cost of labour available. In Queensland the general technique is as follows:—Varieties which it is thought

desirable to try out as parents are planted in a plot in the Freshwater district, near Cairns, where arrowing is usually heavy. In making any particular cross the arrow of the cane selected as the female parent is left growing in the field; just before the flowers commence to open this arrow is surrounded with several arrows of the variety selected as the male parent. The stalks of the latter are stood in a special solution containing sulphurous and phosphoric acids (see Plate 101); this solution

Plate 101.

Arrows of the variety selected as male parents are stood in a special solution and carried to the field, where they are set around the female arrow. (After Mangelsdorf.)

will keep the stalk and arrow alive for weeks, and will allow the normal shedding of the pollen to continue. The canes of the male variety are tapped lightly each morning in order to facilitate the shedding of the pollen.

It is very desirable that the parentage of each seedling should be known with certainty; consequently the variety used as the female parent is chosen because it produces little or no pollen and the male arrows are clustered closely around so as to prevent the deposition of any pollen from other varieties growing nearby. In the case of the older seedlings, such as B. 208 and Q. 813, the seed was just collected in the field, and so only the female parent is known; as a result we are unable to repeat the crosses which produced them.

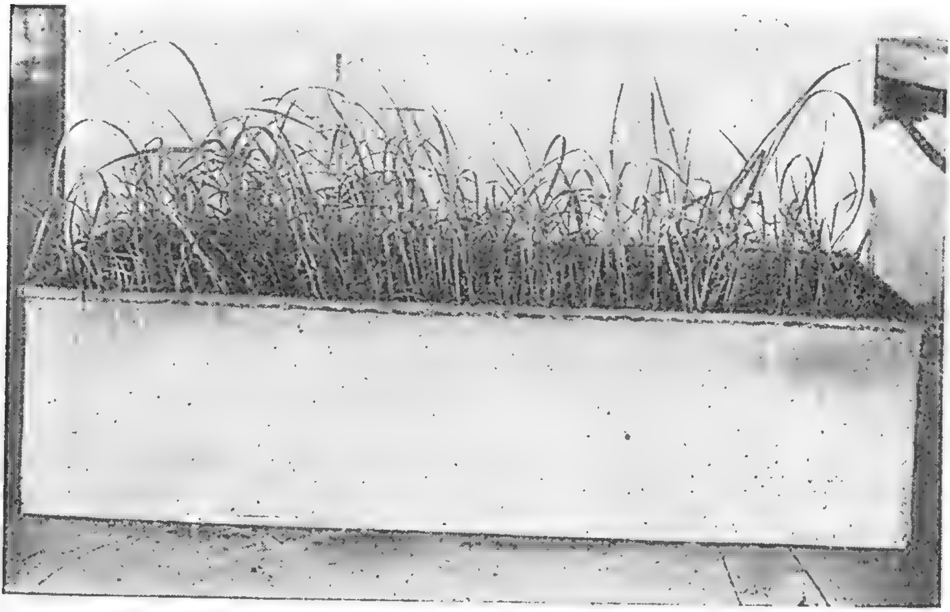


Plate 102.
Seedlings growing in the germination flat, five weeks old, and ready for potting.
[*Photo. by N. J. King.*

When all the tiny flowers on the female arrow have opened and died off, the male arrows are removed and the female arrow is bagged until the seed has ripened, this ripening usually taking some two or three weeks. The seeds are considerably smaller than a pin's head and are light to dark-brown in colour. They do not keep well and, unless stored under special conditions, must be planted immediately if reasonable results are to be obtained. Seed will not set on the arrows produced by the cane in the Mackay and Bundaberg districts, and so all crossing work is carried out at Freshwater and the "fuzz" is sent to the other stations for germination.

The seed is planted in flat wooden boxes containing a mixture of soil, well-rotted manure or leaf-mould, and sand, only a light covering of soil being applied. The boxes are usually set in glass houses or frames which can be heated during the late winter and early spring months when germination is carried out. The seeds germinate after a few days, and the young seedlings appear very similar to certain young grass seedlings at this stage. They are very delicate, and for some time require constant attention to prevent damage by heat, low humidity, or damping-off fungi.

At the age of about four to five weeks they are transplanted from the flats into pots consisting of a length of galvanised iron piping, about 8 inches long by about 3 inches in diameter (see Plate 104). After about eight weeks' further growth they are transplanted into the field. A hole is dug at the base of a plough furrow and the core of soil, with the roots intact, is tapped out and set in the hole. The seedlings then grow in the field until about August or September, when the selection of the best canes is made.

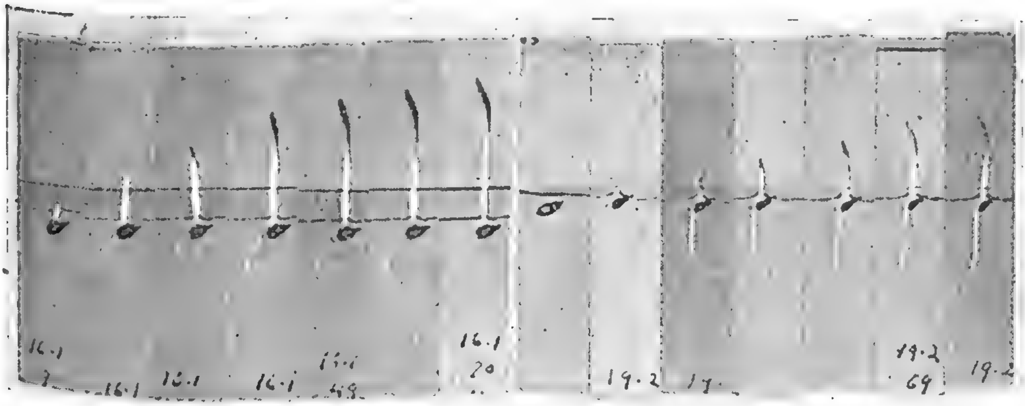


Plate 103.

Photographs taken at daily intervals after the sugar-cane seed has germinated. The seedling on the left had as parents P.O.J. 2878 and P.O.J. 2940, while that on the right was obtained from P.O.J. 2722 and H.Q. 409.

[*Photographs by W. Cottrell-Dormer.*

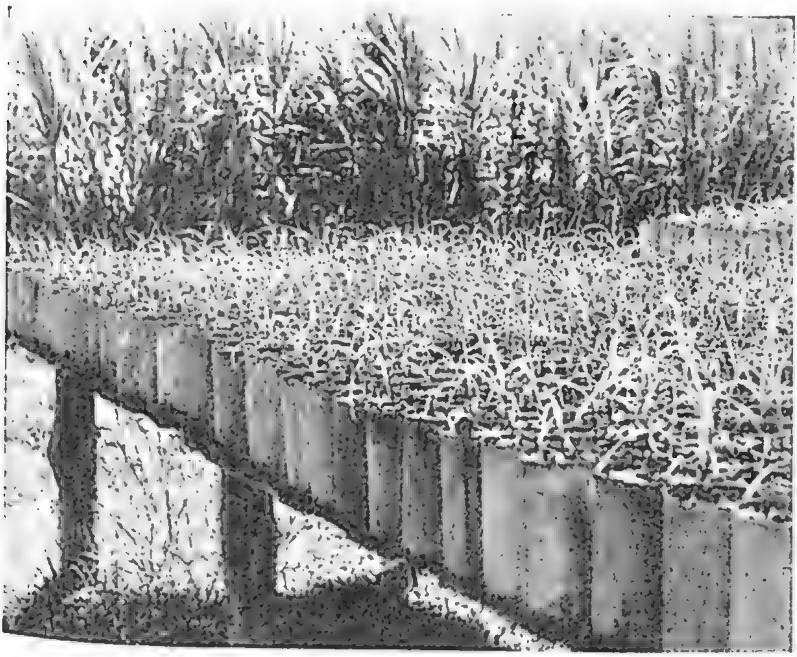


Plate 104.

Young sugar-cane seedlings growing in galvanised iron tubes; these seedlings are ready for transplanting into the field.

[*" Telegraph," Photo.*

Plate 105.
Seedlings being transplanted from pots to field at the Bundaberg Experiment Station.

[Photo. by N. J. King.

Plate 106.
Photograph illustrating difference in growth in adjacent seedlings of the same cross. Age, five months.

[Photo. by N. J. King.

The progeny of any one cross may vary to an extraordinary degree, ranging from fine upstanding stools of 10 to 12 or more stalks per stool, to units which produce practically no cane. Selection is made on the basis of vigour of growth, sugar content, formation of the eyes, type of growth (i.e., whether it is sprawling or not), and so on. As a rule, only about one in a hundred original seedlings is selected for further trial. Thus, if we raise 10,000 seedlings, only about 100 are selected for a second planting, the rest being milled and discarded. It might be thought that such wholesale rejection is rather severe, but there are two points to be borne in mind. Firstly, if we can produce one really good seedling per year which will replace a standard variety, we will be more than satisfied, and if there is only one really good seedling in a batch of 10,000, then it surely should be included in the hundred selected. Secondly, the area of land and facilities available do not permit the handling of large numbers of second and third year seedlings.

Such seedlings as are selected from the original stools are planted out in short rows interspaced with standard varieties and, at maturity, selections are again carried out as in the first year, but naturally with closer attention to detail; about 10 per cent. of these are selected. Third and fourth year tests are carried out on a larger scale, and attention is paid to germination and ratooning qualities, while in the meantime resistance to major diseases has been determined. Finally the 10,000 seedlings are reduced to perhaps two or three which are considered worthy of trial on farms, and these are then set out in comparative trials with standard varieties on different soil types.

Plate 107.

Comparison of P.O.J. 2725 and a seedling raised and now being tested at the Bundaberg Station. [*Photo. by N. J. King.*

The two outstanding seedlings which have been produced since cane breeding began are P.O.J. 2878 in Java and H. 109 in Hawaii. P.O.J. 2878 was rapidly planted to 98 per cent. of the area, but, unfortunately for the Java planters, they have not reaped the full benefit of this cane owing to drastic reductions in their sugar markets. In Hawaii, even if the Experiment Station had never done anything else of value, its existence would still have been eminently justified, since the cost of its maintenance since its inception has been many times repaid by the extra profit accruing from the planting of H. 109.

The qualities required in a cane breeder are many. He must be a model of patience, painstaking care, and capacity for hard work and long hours. He must be optimistic with an optimism tempered by caution; stout-hearted so that he shall not despair when a promising "world beater" must be discarded on account of disease susceptibility; sympathetic towards and intensely interested in his large family, but ruthless in his destruction of all members who fall short of rigid standards.

On the other hand, the canegrower himself must also be optimistic regarding the final results of a cane-breeding programme. We must ask him to be patient and tolerant also, since it requires time to determine the types of cross and then develop the individuals best suited to the soil, climate, agricultural and disease conditions of each district.

A final word. We are sometimes asked the question, "Why try to breed superior varieties when there is already over-production of sugar?" The answer lies in the reason why farmers till their land before planting and cultivate and fertilize the crop. The function of an Experiment Station, through the efforts of its plant-breeding staff, is to produce superior canes of higher sugar content and thus reduce the unit cost of sugar per acre. The question as to what extent over-production exists and how it shall be controlled is a problem for the economic and not the agricultural advisers of the industry.

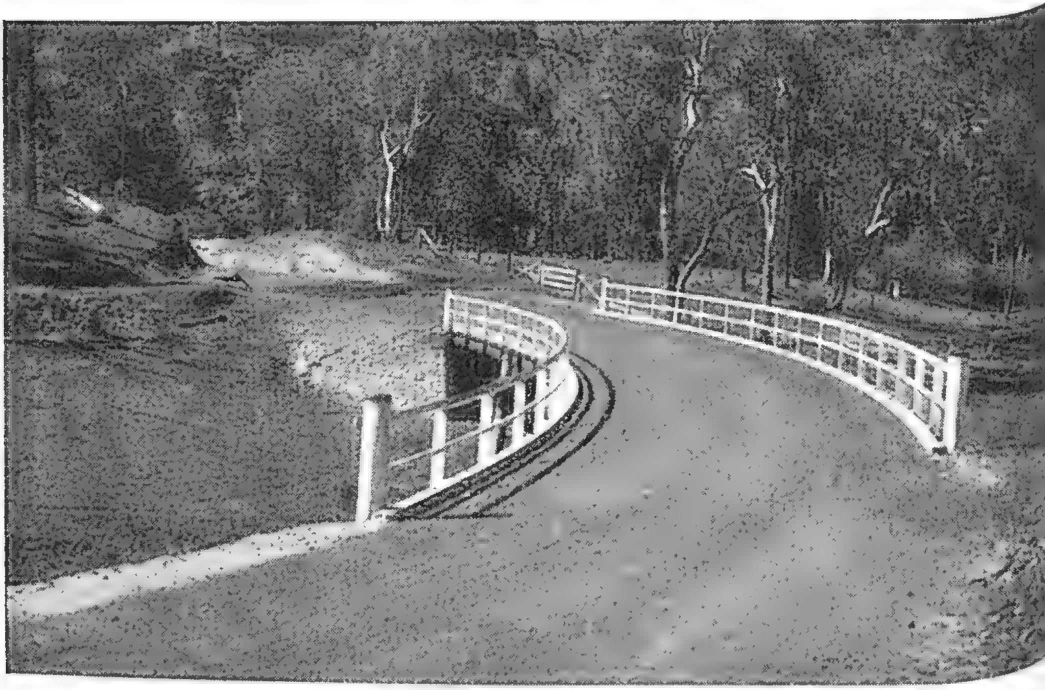


Plate 108.
The Road Through the Forest, Tarampa Shire—Lockyer—Darling Downs Highway.

[*Block by Courtesy Main Roads Commission.*

Fiji Disease in South Queensland.

G. A. CHRISTIE.*

FOR many years gumming disease has been responsible for greatly depressed yields in the cane crops of South Queensland, but by substituting disease-resistant canes for the more susceptible varieties the position has been greatly alleviated and losses are rapidly becoming negligible. In order to combat gumming disease it has been necessary to extend the plantings of P.O.J. 2878 and, to a less extent, P.O.J. 2725, two varieties which are susceptible to another important disease—Fiji disease. This disease is more common in the southern districts but is present on a few farms in the Bundaberg-Isis district. The importance of this disease should not be under-estimated, especially in those districts where P.O.J. 2878 holds such promise, and it is in the interest of all canegrowers to assist in its eradication or control.

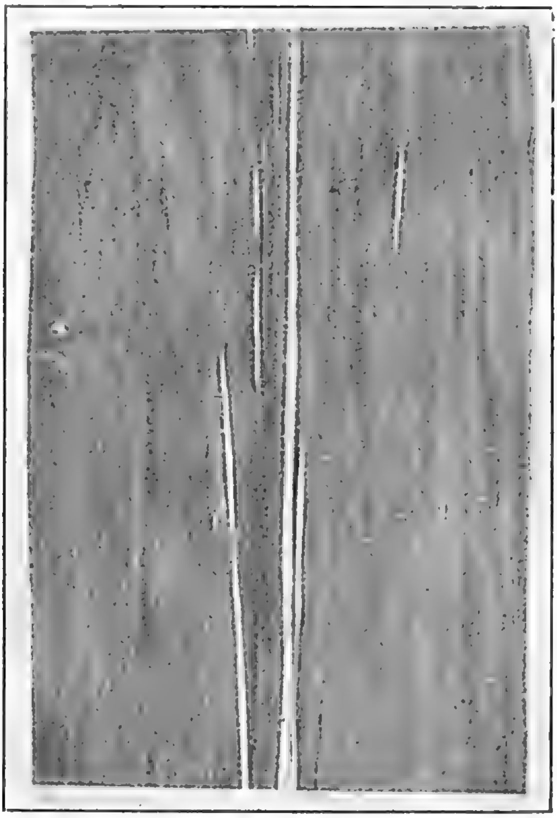


Plate 109.
Illustrating typical galls on the underside of a diseased leaf.

Fiji disease was first recorded about thirty years ago in the colony from which it takes its name. The industry in these islands was threatened for some years and the crops were seriously affected by the ravages of the disease. It probably originated in New Guinea, and by the interchange of varieties has since spread to Fiji, Australia, and the Philippine Islands.

The earliest symptoms and the outstanding characteristic of the disease is the presence of small yellowish galls which are formed on the under surface of the leaves of diseased cane. These galls may be

* Reprinted from the "Cane Growers' Quarterly" by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

one to many in number and are usually 1/32 to 1/16 in. in diameter, ranging from $\frac{1}{8}$ in. to 2 in. in length; they are formed by the enlargement of the veins. (See Plate 109.) In the later stages of the disease the leaves become shortened and erect, very stiff and brittle, and take

Plate 110.
Illustrating the stiff, stunted, and malformed leaves of a well-advanced stage of secondary infection.

on a darker green colour. In this stage the cane top looks as though it had been eaten by some animal. When such distortion of the top occurs no further growth is made, the leaves become smaller and smaller and eventually the heart dies. (See Plate 110.)

When diseased setts are planted they invariably give rise to diseased stools, which in most cases produce no cane but remain a cluster of stunted grass-like shoots; the ratoon stools from diseased plant stools are also of this type. (See Plate 111.)

Plate 111.

The two small grass-like stools in the foreground are the result of ratooning diseased stools. Variety, P.O.J. 2714.

Fiji disease is permanent, and no authentic cases of recovery from the disease have been observed. It should be stated that the disease bears a resemblance to other minor troubles, particularly to clustered stool, which was described in the "Quarterly Bulletin" for 1st July, 1935 (page 8). The question as to whether Fiji disease is present or not can be settled by the presence or absence of the small leaf galls described above.

The investigation of the manner in which the disease is spread from diseased to healthy cane was successfully undertaken by the Bureau some years ago. Contrary to the belief of many growers, it has been established that no soil infection occurs. After ploughing out and killing diseased cane the soil does not remain infective to cane planted at a later date. Nor does cutting diseased and healthy cane alternately with the same knife produce infection in the healthy cane. The only known means by which Fiji disease is spread is through the feeding activities of the sugar-cane leaf-hopper, a small brownish insect about 1/5 in. in length. After these insects are fed on diseased cane they are capable of infecting any susceptible healthy cane on which they feed. Although cane becomes infected in this way, it does not bear any symptoms for some time after the diseased hoppers have fed on it. Often such diseased cane may appear healthy for some months, and this naturally complicates the job of selecting healthy planting material.

CONTROL.

The methods of control which are recommended, are—

(1) Plant only disease-free cane.

(2) During scarifying and at other times inspect all plant and ratoon cane and dig out any suspicious stools. The leaf-hopper which spreads this disease becomes very scarce during the winter and remains so until about December. Therefore, inspection and digging out of diseased stools should be carried out by November-December.

(3) Restrict ratooning of diseased crops.

(4) The better the conditions for cane growth the better are conditions for the spread of Fiji disease. Therefore, special care is necessary on rich alluvial land or irrigated farms.

(5) Where the disease is well established and spreads rapidly, resistant varieties should be planted. The choice of variety will depend, of course, on what other diseases are present; the best known resistant varieties are P.O.J. 213, P.O.J. 234, Co. 290, Q. 813, H.Q. 285, and Mahona; Korpi and Oramboo are also satisfactorily resistant, while P.O.J. 2379 shows promise in this respect.

DISTRIBUTION OF THE DISEASE.

During this and the previous season a considerable amount of field survey work has been carried out by Bureau officers, and the results are briefly set out below:—

Bundaberg.

Continued field inspections and digging out of diseased stools, together with supervised plant selection, has reduced the disease considerably at Bingera, though infection is still present and the situation requires close attention. In the Kalkie quarantine area, disease surveys have revealed a reduction in the number of infected farms and in the degree of infection. Nevertheless, the disease is by no means under control on some of the river-flat farms, and some more rigid form of control may become necessary.

Isis.

The disease was reported on several farms some years ago, but with the co-operation of growers and mill officers it was speedily brought under control. Recently it has been found on two neighbouring farms, one of which had carried the disease previously. Owing to the extensive plantings of the very susceptible variety P.O.J. 2878 the present outbreak must be regarded more seriously than the previous one.

Maryborough.

A considerable amount of inspectional work has been done in this district, and since February last year some 350 farms have been inspected at least once. In the Maryborough district proper the disease is present to a considerable degree, and the use of resistant varieties should be more widely adopted. In the Yerra-Antigua section the disease was found on 27 farms in a total of 127 inspected, while 7 in a total of 92 inspected were infected in the Pialba-Takura section. In both cases, however, the infection amounted to only a few stools per farm, and hence the situation should be readily controlled by the application of a little care on the part of the farmers concerned. At Mount Bauple 2 infected farms were found in the 72 inspected, so that the situation in that locality could readily be controlled.

Moreton.

A survey of a portion of the area showed that Fiji disease was present on 11 farms in 88 inspected. These farms included all that might be suspected of having the disease, and therefore the situation is better than appears at first sight, although definitely serious in view of the value of P.O.J. 2878 in this district. With one exception the disease amounted to a very few stools per farm.

HOW FREQUENTLY DO GIANT TOADS PRODUCE EGGS?

We have been asked repeatedly whether the toads lay but once in a year or whether they can produce eggs at more frequent intervals. In order to try and find an answer to this question numbered arm bands were placed on females which were definitely observed depositing eggs. Now, for the first time, we have a record of one of these banded females laying again. No. 1, which produced 16,000 eggs on 17th March last, was captured in the act of laying a further large batch on 30th May. Unfortunately, her egg strings were intertwined with those of eight other toads which laid on the same day, so it was impossible to determine accurately the number which this individual laid. The total number produced by the nine females on this morning was 125,000.

At least 52 toads have laid at Meringa since the 17th November, 1935, and as we have only 37 females in all, several have laid more than once.

It is of interest to record that not less than 1,560,000 eggs have been laid to date, and approximately 62,000 toadlets have been caught and distributed. Male toads are to be heard calling almost nightly in Tully and in parts of the Gordonvale area.

J.H.B., in the "Cane Growers' Quarterly."

Subterranean Waters of the Woongarra Lands.

THEIR SUITABILITY FOR IRRIGATION.

N. J. KING.*

THE past four or five years have seen in Bundaberg the advancement of irrigation from an experiment to an outstanding commercial example of crop control. The large Bingera and Fairymead Plantations, with two basically different schemes of water production, have shown that successful irrigation of cane is just as practicable in the sub-tropical south as in the Burdekin delta. The refusal of the Bundaberg farmers (in the proposed benefited area) to be burdened with a community irrigation undertaking has left the onus on the irrigation-mined grower of developing an individual plant for his farm requirements. In the immediate Bundaberg district this involves the search for underground water, as very few farms have access to river water of the necessary purity.

A number of growers have already investigated the subterranean supplies on the forest lands of South Kalkie, Clayton, and Gooburrum; and in most of the cases which have come under the writer's notice, success has rewarded their efforts. The few cases where difficulty has been encountered have probably been due to unsuitable spears or failure to lodge the spears in the proper drift, but in no case has the water been unsatisfactory. It is the purpose of this article, however, to discuss the subterranean supplies of the Woongarra lands, as here the problem is a particular one, and one about which divided opinions are held by local growers. Space will not be taken up by discussing the suitability of the red volcanic soils for irrigation. This has been definitely proved, if proof were needed, by the few plantations and farms on which irrigation plants have already been installed. Rather is it proposed to show the suitability of most of our waters for irrigation.

As far back as 1905 Dr. Maxwell, then Director of Sugar Experiment Stations, carried out a water survey of the Woongarra area with a similar object in view. His report of 1906 contains some valuable and surprising figures in the light of the fact that the general current opinion regarding the underground water supplies is that they are not fitted for irrigation purposes. Tabulated in his report are the following figures:—

No. of Waters.	Total Solids, Grains per Gallon.	Salt, Grains per Gallon.
	From—	From—
6	1 to 10	2 to 6
52	11 to 20	3 to 14
46	21 to 30	3 to 28
17	31 to 40	9 to 32
11	41 to 50	14 to 28
8	51 to 60	22 to 40
2	61 to 70	24 to 32
9	71 to 80	29 to 51
3	81 to 90	33 to 43
8	91 to 100	43 to 61
20	101 to 150	40 to 85
4	151 to 200	86 to 120
2	201 to 250	107 to 133
1	251 to 300	145
1	301 to 350	104
1	351 to 400	229
1	401 to 450	242
1	550 to 600	462
1	650 to 700	427

* Reprinted from the "Cane Growers' Quarterly" by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

From the above 194 samples from wells on the Woongarra, 182 are considered suitable for irrigation *on the Woongarra soils.* Reasons are given below for this belief. It must be remembered that in 1905 the quality of these waters was probably as low as it had ever been, as four droughts had been experienced in the previous five years. Unfortunately we cannot accept the above tabulated figures on their face value. These wells, probably sunk for domestic or stock purposes, were in many cases shallow wells tapping only surface water. Similarly one cannot be certain that, if subjected to severe pumping test, the quality of the water would not change, becoming more or less saline. Another objection is that unless tested with a pump over a fair period, no idea of the amount of water available for irrigation could be obtained.

In 1933 the writer was instructed to carry out a similar survey of the then existing wells. A considerable amount of work resulted in a similar unsatisfactory position. From farm to neighbouring farm well waters varied from excellent to very saline, but in most cases, as above, the wells were sunk purely for domestic supplies, and not with a view to large water output. Consequently most wells were shallow—less than 50 feet—and the greatest pumping strain exerted was that of a windmill. No conclusive data can be obtained from the analysis of such samples. A shallow well may give excellent quality water, but a poor supply. The deepening of such a well to increase the output has resulted on occasion in tapping a deeper supply of lower quality. Experience of the necessity for carrying out a pumping test before installing a pumping plant was gained on the Experiment Station in 1934. The well on the Experiment Station has long been known for the excellence of the water quality—3 grains of salt per gallon—and its ability to stand up to continued pumping during droughts. For many years a windmill was the sole test of the well. Some years ago an engine and pump-jack were installed, pumping approximately 900 gallons per hour, and in 1934 this was replaced by a small centrifugal pump delivering 2,000 gallons per hour. Neither of these small pumps made any appreciable impression on the water level in the well. As the well is only some 42 feet deep the performance was considered a good one. In 1934 we investigated the possibilities of irrigation, and a 3-inch pump was installed temporarily on the well. It succeeded in emptying the well containing its usual 20 feet of water in approximately half an-hour. It could be calculated from the speed of drop of the water, and the rapidity of filling after stopping the pump that the limit of the well would be some four to five thousand gallons per hour.

The above and other cases which have been investigated exemplify the impossibility of calculating the water capacity of a well without actual pumping data. In the above case a bore was put down at the bottom of the well to a total depth of 170 feet without encountering a water-bearing stratum. On another site on the station a bore was sunk to 140 feet, and the only water found was a surface supply between 15 and 45 feet. With four of these bores we were able to obtain a supply approximating to 9,000 gallons per hour. This one instance is sufficient to show that underground water in large amounts cannot be obtained everywhere on the Woongarra. A popular statement is that water can be obtained anywhere if one goes deeply enough for it. Possibly true, but the problem and cost of lifting it must be considered.

It was mentioned above that 182 of the samples of water obtained were suitable for irrigation *on the Woongarra lands.* By this is meant that although suitable here the same waters may not be harmless on sandier soil types. Due to recent developments in soil science and greater knowledge now current on soils and irrigation, waters considered unsuitable for irrigation twenty years ago are now frequently recommended. Not only the water but the soil type must be considered in interpreting water analyses.

During 1933 the well water at Qunaba was investigated insofar as its effect on the Qunaba volcanic soils was concerned. It was desired to find out whether ill effects were likely to accrue from using a water containing 121 grains of total solids, with 89 grains of salt per gallon, on the Qunaba soils. It was already manifest that the water would produce an excellent crop, but the effects of the continued use of it over a number of years were problematical. A detailed analysis of the water was as follows:—

	Grains per gallon.
Chlorides (calculated as common salt)	88·8
Total hardness (calculated as lime carbonate)	49·7
Total solids	121·6
Detailed analysis:—	
Chloride	53
Bicarbonate	18
Sulphate	12
Silica	3
Calcium (lime)	6
Magnesium	9
Sodium	20
Potassium	0·35
Total	121·35

It will be observed that the concentration of magnesium salts exceeds that of the lime salts. There was the remote possibility that a concentration of magnesium in the soil may prove detrimental to plant growth. The following test was applied:—A two-foot column of the soil was taken and subjected in the laboratory to leaching with Qunaba water—the equivalent of 20 acre-inches of water being used. This would be comparable with 4 five-inch irrigations. A similar column of soil obtained at the same time was not treated with the water. Both of these samples were taken after irrigation had been carried out with the Qunaba water for five months. Later, after the April, 1933, rains, which aggregated some eight inches, a further sample was taken from the same site to observe the effect of rain in washing out any accumulated salts. The fourth soil sample was taken from a non-cultivated adjacent area which received no irrigation water.

Soil.	pH (Measure of Acidity).		Available Bases as M.E. per 100 Gms.				Available Phosphate p.p.m.	Lime Carbonate %	Chlorine %
	In Water.	In KCl Soln.	Ca (Lime).	Mg (Magnesia).	K (Potash).	Na (Soda).			
No. 1 soil irrigated for 5 months and sampled following a 5″ application	8·27	7·74	32·9	13·1	·43	1·05	481	·32	·03
No. 2 identical with No. 1 but leached in laboratory with further 20″ of water	8·30	7·76	33·3	12·5	·35	1·20	540	·24	·03
No. 3. As No. 1 but sampled after April rains	8·19	7·56	20·8	10·5	·35	1·20	206	·21	·02
No. 4. Non irrigated soil	8·20	7·36	13·8	5·9	·16	·59	169	·03	·006

There is no evidence here of serious accumulation of salt. There is a slight increase in sodium, but so slight as to be almost insignificant. On the figures obtained there appears to be no reason why this water should not be used for crop production on these soils.

It must not be assumed, however, that similar remarks apply to other soil types. On the general run of the Bundaberg forest lands, the subterranean water is of good quality—less than 10 grains of salt per gallon—but it sometimes occurs, on farms near tidal rivers, that the underground water is more saline. In any case outside the red volcanic soils, where only average quality water is procurable, advice should be obtained before continued use for irrigation is practised.

The statement that water unsuitable for washing (that is, which will not lather freely with soap) is unfitted for irrigation is quite incorrect. Many waters contain lime in solution and these certainly could not be used for washing; yet the lime would have a beneficial rather than a deleterious effect on most soils.

"Humus"—What is It?

N. J. KING.*

THROUGHOUT the literature of agriculture from all parts of the world the word "humus" is conspicuous. In seeking a definition we find that "humus" is described as "the somewhat indefinite nitrogenous and carbonaceous material resulting from the decay of plants." When plant remains are added to the soil some of the constituents tend to undergo rapid decomposition. This decomposition is the result of the microscopic population of the soil, which utilizes the material as food. The speed of the decomposition depends on the nature of the plant residues and on the type of soil. Other factors such as temperature and moisture greatly influence the rotting-down of the material also.

The partially decomposed material forms a vague and indefinite group of substances to which has been given the name "humus." It has important physical effects on the soil and possesses a number of properties not usually shown by undecomposed plant residues.

Firstly it causes the soil to become "puffed up," and so leads to an increase in the pore space in the soil. This results in a marked improvement in tilth and general physical condition; secondly, it increases the moisture-holding capacity of the soil, since humus has an enormous capacity for absorbing water as compared with the soil minerals; thirdly, although humus is essentially transitional, it has a certain degree of permanency and only slowly disappears from the soil. It disappears more rapidly in tropical than in temperate regions, and more quickly in sandy soils than in loams and clays; finally, humus is rich in nitrogen, which is now universally acknowledged by farmers as an essential factor in cane growth.

In certain European countries where intensive farming is necessary, the utilization of farmyard manure is the general rule, but the production of soil humus by this means on cane farms could not, for obvious reasons, be considered. The canegrower, therefore, grows green crops to be ploughed in, and in some cases utilizes plant residues in the form of cane trash in an attempt to improve his soil. The value of these practices may be considered as follows:—

It will be readily admitted that an improvement in soil tilth is always desirable, and that an increase in moisture-holding capacity would be welcomed on all except the badly-drained farms. Likewise a supply of nitrogen per medium of humus would constitute a saving in fertilizer outlay. If these three objects can be gained by increasing the humus content of the soil, then the end justifies the means employed. In the growing of a green manure crop (Poona pea, Mauritius bean, cowpea, &c.) advantage is taken of the fact that these crops belong to a certain class of plants known as legumes. Legumes have the property of being able to assimilate nitrogen from the atmosphere through the co-operation of bacteria which make their home in the nodules on the plant roots. It is recognised, therefore, that such plants when ploughed in are enriching the soil with so much nitrogen which they have taken from the air. This property is not possessed by sugar-cane, maize, sorghum, and other plants, which return to the soil only such nitrogen as they have taken from it.

A good crop of Poona pea will produce 15 tons of green matter to the acre, and the ploughing in of this mass of material must, when

* Reprinted from the "Cane Growers' Quarterly" by courtesy of the Director, Bureau of Sugar Experiment Stations.

rotted, undoubtedly improve the mechanical condition of the soil. The amount of nitrogen thus added to the soil would be equivalent to approximately 700 lb. of sulphate of ammonia to the acre. The ploughing in of a 15-ton crop of maize would apparently have the same effect on the soil tilth, but other factors operate against it. The prime requirement for rapid and complete decomposition of a green crop—apart from temperature and moisture—is a good nitrogen supply. Decomposition proceeds by means of bacteria and fungi, and a balanced food supply of nitrogen and carbonaceous material is essential for the working of these microscopic labourers. In the case of Poona pea and other legumes the balanced ration is present, but with other crops or a body of trash the nitrogen supply is too low, and the rate of decomposition is retarded. There are two methods of speeding up the rotting of trash—(1) To sow a green manure crop (such as Poona pea) as soon as the trash is ploughed in. This, when ploughed in, in turn, will supply the nitrogen for the rotting of the trash as well as itself; (2) to broadcast sulphate of ammonia on the trash before ploughing in, and thus ensure the necessary food for the bacteria. The method adopted will, of course, be decided by the particular farm or plantation practice.

No doubt many farmers have seen the result of ploughing in trash with no subsequent attempt to supply nitrogen to the soil for decomposition. The writer has observed cases where trash has remained unrotted for twelve months after turning in, only because no green crop was grown, to be ploughed under and assist in the process.

The effect on numbers of soil micro-organisms of ploughing in plant residues is shown by the following figures. Recently one of the Bureau pathologists carried out an investigation on a block on the Bundaberg Experiment Station which is being used as a trash experiment. One portion of the block has been farmed according to standard practice, while the other portion has had all trash ploughed in since 1932. The decomposition of the 1935 trash and the subsequent Poona pea crop were practically complete when the counts were made.

——	Bacteria and Actinomyces.	Fungi.
Trash Plot	108,120,000	2,400,000
No Trash Plot	14,530,000	550,000

These figures are per gram of soil.

It should always be kept in mind that humus affords energy to numerous micro-organisms, and is gradually converted by them into simple substances appropriate for plant nutrition. We may look upon its constituents as taking part in a perpetual cycle—in one stage nourishing the growing plant and storing up the energy of sunlight; in the other stage nourishing micro-organisms and liberating energy and plant foods.

Sometimes humus is lost, sometimes worn out, and at other times destroyed. Rains and floods will often wash humus away from hillsides. Micro-organisms will use it up in the process of making soluble compounds, and it is destroyed by oxidation and by fires. Any intensive method of cultivation increases oxidation, thereby reducing the humus content unless provision is made to replenish the supply by ploughing in more green crops or trash.

Temperature is a very important factor in humus formation and destruction. Humus will be formed wherever conditions of temperature and moisture allow the growth of crops and the survival of micro-organisms in the soil; and humus will be destroyed by micro-organisms under exactly the same conditions. But as the destruction of organic matter is relatively proportional to the temperature we find that two zones can be classified—(1) In which humus will accumulate: here the conditions are more favourable to formation than to destruction, and the temperatures vary between zero and 77 degrees F.; (2) in which humus is destroyed more rapidly than it is formed (assuming that adequate air and moisture are available). This occurs at temperatures above 77 degrees F. This is shown diagrammatically in Plate 112. Here

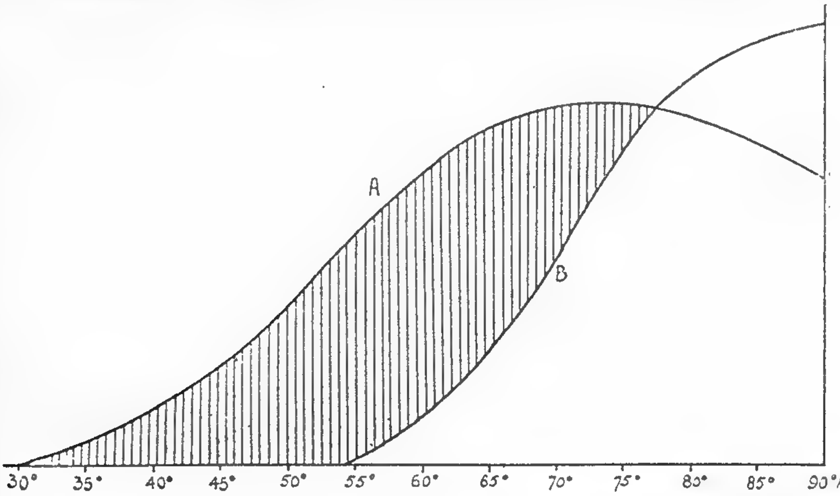


Plate 112.

Curves showing the relationship between temperature and (A) rate of humus accumulation, and (B) rate of humus decomposition. It will be noted that temperatures experienced in the Queensland cane areas lie on those portions of the curve where rates of decomposition are high.

the base line records temperature, and the perpendicular line represents humus formation or loss. The curved line A represents humus formation at different temperatures, and the line B shows humus destruction. The shaded area is therefore the zone of humus accumulation, wherein humus is formed more rapidly than it is destroyed.

The following question is often asked by farmers on the red volcanic soils. Since we already have good tilth, and can supply nitrogen conveniently from a bag of sulphate of ammonia, why go to all this trouble to provide humus? Apart from the argument of increasing the moisture-holding cacapity of the soil, the following convincing reason may be given:—Recent work in the Brisbane laboratories of the Bureau has shown that the addition of trash to three of Queensland's major cane-producing soil types has resulted after twelve months decomposition in large increases in the amounts of available plant foods in the soil. The process of decomposition of organic matter has evidently a weathering effect on the soil particles, thus transforming insoluble compounds into an available form. An extremely important feature of this same work is that the trash treatment of the soil decreased the soil acidity, thus disproving the popular theory that organic matter would make the soil more acid.

Sheep-breeding.

JAS. CAREW, Senior Instructor in Sheep and Wool.

SHEEP-BREEDING in Queensland is confined almost entirely to the Merino for the purpose of producing wool. The enormous area of country over which sheep are run embraces such a wide range of conditions, soil, and climate, which influence the growth and variety of grasses, shrubs, herbage, and edible trees, that it can be fully appreciated that all Queensland sheep country is not suitable for sheep-breeding, apart, of course, from ordinary flock maintenance and increase. Many breeders scattered over an area extending from the New South Wales border to the north-western portion of Queensland are, however, now breeding good quality flock rams, both for their own use and for sale, while some of these breeders are coming into prominence through their establishment of special stud flocks. Large numbers of rams are introduced from New South Wales chiefly, and their influence in improving the type here is well known and appreciated.

This improvement, together with the influence exercised by local success on the minds of sheep breeders, has inspired a confidence which is resulting in a tendency to improve the type and standard of present flocks. The introduction of high-quality stock is always an advantage if they are of the proper type and suitable to the conditions under which they are to live. It is not the introduction of fresh blood that counts for improvement, unless it is of the correct strain and type which possesses the power of prepotency, that is, the power possessed by some animals of stamping their characteristics on their progeny. When a sire of high quality of the desired type is found to possess this power of dominance or prepotency his value should be fully appreciated. It is only the keen and attentive sheep breeder who detects the desired quality in young sheep who will be able to trace these special features to the sire. When commencing on flock improvement the ideal should be pictured in the mind's eye. Obtain a sire of the desired type, and select ewes that should be suitable. If the progeny are true to type, see that the standard is maintained by breeding on correct lines. In order that the pedigree of prominent strains may be watched, flock

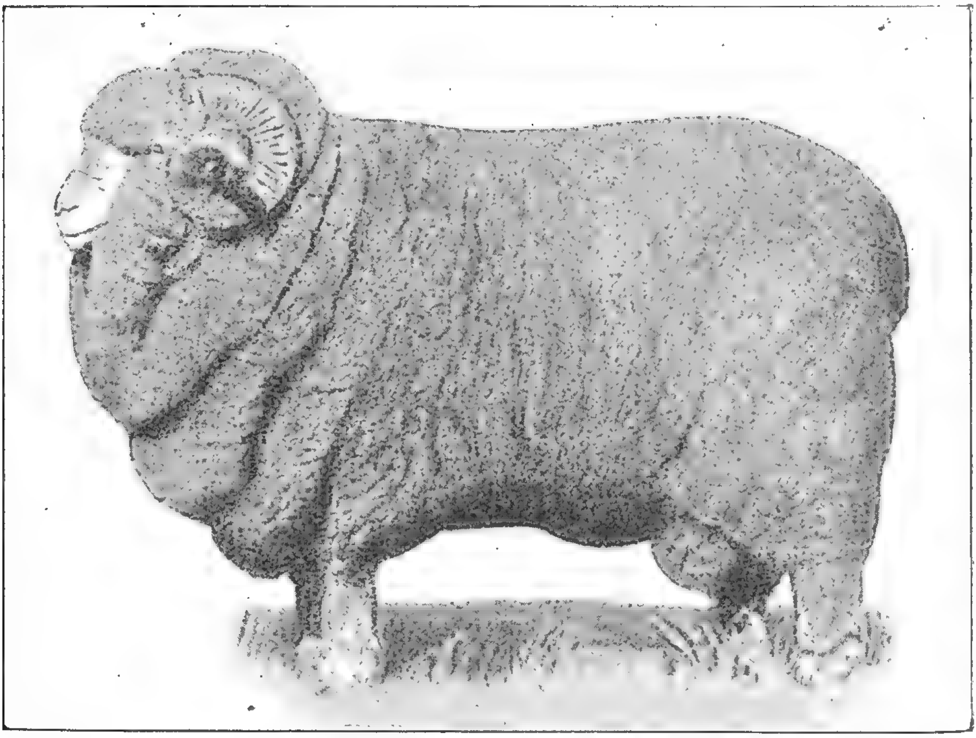


Plate 113.
A Good Type of present-day Australian Merino Ram.

books are necessary. Feeding, local conditions, and environment have also an important influence on successful sheep-breeding.

In Queensland the normally dry late autumn, winter, and early spring, with the consequential shortage of suitable green feed is a serious handicap in some districts. A supplementary ration, rich in protein, will be a decided advantage in times of hard, dry feed and scarcity.

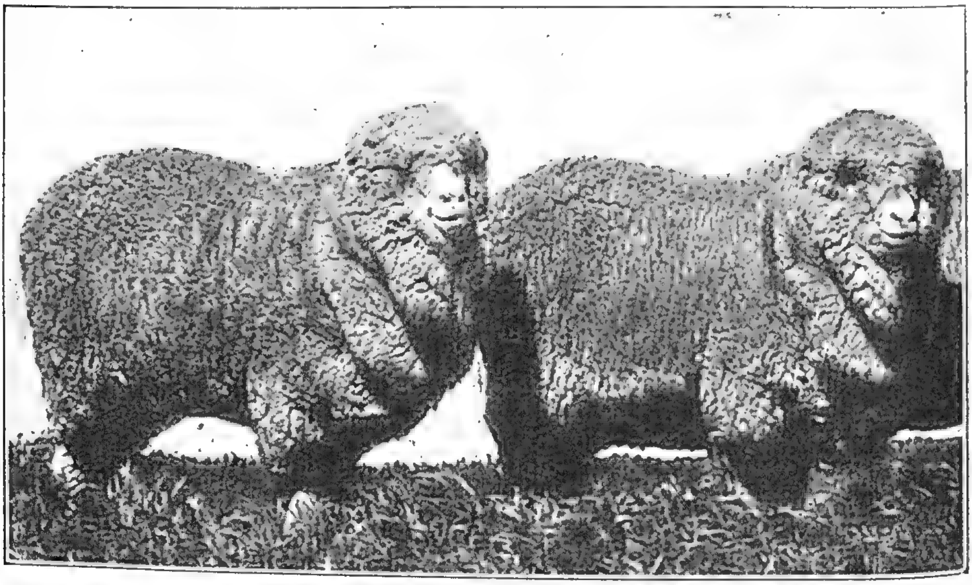


Plate 114.
Merino Ewes.

A Pasture Improvement Programme.

C. W. WINDERS, B.Sc.Agr., Assistant Agrostologist.

DURING the period of conversion of holdings from the virgin state into grazing farms, pioneering conditions necessarily prevail, and settlers with limited capital are obliged to direct their energies to the most urgent requirements, such as clearing and sowing grasses that become established quickly. Most districts have now passed out of the pioneering stage, however, and landholders in such districts are wisely devoting more attention to pasture management and pasture improvement.

There are three distinct angles from which the problem of producing better pasturage may be approached, namely:—

(1) Better use of existing pastures;

(2) Improvement of existing pastures by renovation and topdressing;

(3) Laying down of superior pasture mixtures.

In order that the best possible use may be made of the better-class grazing areas on any farm, it is essential that the pastures be divided into fairly small paddocks. Every farmer knows how the production of his herd rises when the fresh bite is substituted for rank-growing grass. By having a number of small paddocks which can be grazed in rotation the dairy farmer is assured, at all times during the growing season, of having fresh young grass available for his stock. So important is subdivision, that the erection of fences is recommended as the first step in pasture improvement.

Renovation and topdressing of existing pastures, particularly of old stands, offer other means of increasing production of pastures which are not yielding as heavily as they should. Renovation by means of ploughing or drastic harrowing with special implements corrects the sodbound condition of the grasses and improves the soil conditions. The net result is a fresh lease of life for the pasture. In situations where

crops can be grown, a more effective means of maintaining high producing pastures than periodical renovation is to treat pasture as a unit in a crop rotation, allowing one or two seasons for crops between four-five year stands of pasture.

Although adverse weather very often prevents the full benefit of fertilizer applications from being realised, many dairy farmers and graziers have used pasture fertilizers with encouraging results. Most of our coastal grazing country is deficient in lime, and applications of 1 ton and upwards of agricultural lime per acre have produced a marked improvement in the pasture. Superphosphate and sulphate of ammonia are the two fertilizers used most commonly for pasture topdressing. Usually, it is necessary to renovate a pasture by mechanical treatment before efficient topdressing can be carried out.

On a great number of properties the best of the proven general purpose grasses are well established, but each has its limitations and information is every day being sought regarding pastures for special purposes or for special situations. There is an increasing demand for advice concerning winter pastures. Numerous grasses and clovers have been proved to be useful for winter grazing purposes, and recommendations for various districts are obtainable from the Department of Agriculture and Stock, Brisbane. Farmers desirous of sowing winter pastures for the 1937 season are advised to seek advice at an early date, in order that they may proceed with the preparation of land for sowing.

QUEENSLAND SHOW DATES FOR 1937.

April.

Oakey	7th and 8th
Toowoomba Royal	12th to 15th
Dalby	21st and 22nd

May.

Longreach	3rd to 6th
Beaudesert—	
Show	5th and 6th
Bushmen's Carnival	7th and 8th
Wallumbilla	6th and 7th
Nanango	6th and 7th
Dirranbandi	6th to 8th
Ipswich	11th to 14th
Wowan—	
Show	11th and 12th
Rodeo	13th
Crow's Nest	12th and 13th
Biggenden	20th and 21st
Gympie	20th to 22nd
Warrill View	22nd
Kilkivan	24th and 25th
Maryborough	25th to 27th
Charleville	25th to 27th
Maryborough	25th to 27th
Gin Gin	28th and 29th
Toogoolawah	28th and 29th
Kalbar	29th
Childers	31st May and 1st June

June.

Bundaberg	3rd to 5th
Lowood	4th and 5th
Boonah	9th and 10th
Gladstone	9th and 10th
Rockhampton	22nd to 26th
Marburg	18th and 19th
Mackay	28th June to 1st July

July.

Bowen	7th and 8th
Ayr	9th and 10th
Rosewood	9th and 10th
Cleveland	9th and 10th
Townsville	13th to 15th
Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th and 21st
Laidley	21st and 22nd
Cairns	27th and 28th
Gatton	28th and 29th
Caboolture	30th and 31st
Maleny	22nd and 23rd

August.

Royal National, Brisbane	16th to 21st

September.

Imbil	3rd and 4th
Rocklea	11th
Innisfail	17th and 18th

Poultry Notes.

INCREASE EGG VALUES.

P. RUMBALL, Poultry Expert.

THE well-fed hen produces an egg of maximum food value, and it rests with the farmer to maintain this quality in order to obtain the maximum money value.

Quality and size govern price, quality being the more important. The lack of size is something easily determined, and by using for breeding only birds that lay large eggs, small eggs can almost be eliminated from the market.

To-day eggs of first quality are being retailed at 1s. 3d. to 1s. 4d. per dozen, and in the same street eggs of a similar size may be obtained for 8½d. per dozen. Why the difference? It is due to the internal and to some extent the external quality of the egg. The difference in price is so marked that the average consumer must wonder why, and, to some extent, look with suspicion on the cheaper article. But what of the producer responsible? Does he realise that he is losing at least 6d. per dozen on all the eggs that are sold at 8½d.? His loss is sufficient to pay for all the feed that the birds would consume to produce the better quality eggs; or, to put it in other words, he is going to all the trouble of caring for fowls, carting eggs to market, and incurring other costs without making a profit of one penny piece. Not only is this the case, but he is doing it to the detriment of the man who gives his eggs the necessary attention to maintain market quality, and who has to make his fowls keep him.

Cleanliness of shell is the first essential for the satisfactory marketing of eggs. There is only one degree of cleanliness, although there are several degrees of dirtiness. Cleanliness can be maintained by providing the stock with nests in which clean litter or nesting material is kept, and by gathering the eggs at least twice a day.

Water is usually used for cleaning. It should be changed from time to time, and the cloth used rinsed at frequent intervals. Before the eggs are packed they should be dried off thoroughly to prevent deterioration. Packing should be done in cases and fillers, as the use of materials, such as chaff, &c., soils the eggs; there is also the risk of infection of the egg content by moulds. This infection gains entrance through the pores of the shell.

At the bottom and top of the case, pads of wood-wool or other suitable material should be placed to act as a cushion. Exceptionally large eggs should always be packed on the top layer to avoid breakages, and if petrol cases are used only five layers packed per case.

As the quality of an egg deteriorates with age, frequent despatch to market is essential to secure the highest values. During summer, eggs should be railed twice weekly, and during winter at least once weekly.

Pending despatch, eggs should be stored in a cool place, free from odours, for taints are readily absorbed by the egg.

Many poultry farmers may not have a sufficient quantity to forward case lots twice weekly. To them, it is suggested that consideration be given to the possibility of combining with neighbouring farmers who are in a similar position.

The increased returns that will follow as the result of a little care bestowed on the egg to maintain quality will repay any farmer.

A New Type of Irrigation Sprinkler.

H. W. KERR.*

RECENTLY an interesting type of irrigation sprinkler was imported from England for experimental purposes. It was supplied in response to our demand for a simple and effective spray which would give a wide coverage, and therefore necessitate a small number of units per acre. The essential features of the sprinkler are shown in the accompanying illustration (Plate 115).

Plate 115.

Illustrating the essentials of the sprinkler head. It is mounted for convenience on a tripod with 5-foot legs.

The water is delivered to the sprinkler through a standard hose connection, and it is ejected through a nozzle set at an angle of approximately 45 degrees. A selection of nozzles is supplied with the unit, enabling one to employ that most suited to the volume and pressure of water available. The device by which the water spread is secured is simple and ingenious. The jet from the nozzle impinges on a wheel, the periphery of which is slotted. The force of the water causes the wheel to revolve, and the small fins break up the stream into drops of greater or less dimensions. A few of the fins are turned in such a manner as to offer a direct obstruction to the water flow, and the intermittent impulses caused by these gives the entire head a slow revolving action. Nozzle and wheel are thus carried through a complete circle in a period of from one to two minutes.

The manufacturers claim that the sprinkler will operate at pressures ranging from 10 to 100 lb., while a coverage of ½ acre is possible under the best conditions. The application of water ranges from 5 to 28 gallons per minute, depending on the pressure

* Reprinted from the "Cane Growers' Quarterly" by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

available and the size of jet employed. The coverage is likewise adjustable by these means. The model under trial was supplied for a $\frac{3}{4}$ inch hose connection, and the nozzles were from $\frac{5}{32}$ inch to $\frac{13}{32}$ inch diameter. This unit will irrigate $\frac{1}{4}$ acre. The larger model, with $1\frac{1}{2}$ inch hose connection, is intended for use with water pressures of 55 lb. or more. The nozzle sizes are from $\frac{7}{16}$ inch to $\frac{21}{32}$ inch diameter. This unit will deliver from 30 to 70 gallons of water per minute, and gives a coverage of from $\frac{1}{4}$ to $\frac{1}{2}$ acre.

The price of the sprinkler is listed as £3, in England, and at this cost it should be of interest to many of our canegrowers. Though it suffers all the drawbacks previously outlined for spray irrigation, there are certain uses to which it might be put on the cane farm. As a means of irrigating the kitchen vegetable patch or a small block of horse feed, on a relatively low pressure, it should prove ideal, while to the grower who wishes to exploit intermittent irrigation on young cane, to help it through a dry spell when necessary, the sprinkler is strongly recommended. In this connection it should have a very definite value where the canegrower could provide water in a channel adjacent to the cane block; from this it could be taken up by a portable engine and small pump, and driven through two or three of these units suitably placed in the field of young cane. The advantage it offers, particularly where the water supply is limited, is its ability to enable a 1-inch watering to be applied uniformly and rapidly. On the average values given above for the large, high-pressure unit, 1 acre-inch could be applied to $\frac{1}{3}$ acre, by one unit, in the course of two and a-half hours.

AGRICULTURE ON THE AIR.

RADIO LECTURES ON RURAL SUBJECTS.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by Officers of the Department of Agriculture and Stock.

On Friday of each week a fifteen minutes' talk, commencing at 12.45 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures until the 30th April, 1937.

SCHEDULE OF LECTURES.

BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK, RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Friday, 12th March, 1937—"Plant Nutrition," by E. H. Gurney, Agricultural Chemist.

Friday, 19th March, 1937—"Sheep Management under the Varying Conditions in Queensland," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 26th March, 1937—"The Care of the Flock," by Jas. Carew, Senior Instructor in Sheep and Wool.

Friday, 2nd April, 1937—"Winter Pastures," by C. W. Winders, Assistant (Agronomy).

Friday, 9th April, 1937—"Pork Products as Regular Items on the Menu," by E. J. Shelton, Senior Instructor in Pig Raising.

Friday, 16th April, 1937—"Some Poultry Farmers' Problems. What to Breed and How to Breed," by J. J. McLachlan, Poultry Inspector.

Friday, 23rd April, 1937—"Strawberry Planting and Other Seasonal Fruit Hints," by H. Barnes, Director of Fruit Culture.

Friday, 30th April, 1937—"Wheat Improvement in Queensland," by R. E. Soutter, Agricultural Research Officer.

Identification of Rats Damaging Cane in Queensland Canefields.

W. A. McDOUGALL.*

DURING the many years prior to 1934 when rats damaged cane in Queensland, they were never referred to under any name but the common collective one of "rats." Undoubtedly, this name fully serves its purpose in several ways, but to those seriously interested in attempting to control these pests it is not sufficient.

The amount of research work done on any pest usually bears some relationship to the losses caused by the pest. This is well illustrated by happenings in the Herbert River cane areas during the past two years. There in 1933 and 1934, exceptionally heavy rat damage to cane was experienced. Control measures were applied, but a further result of these heavy infestations was that work was commenced by local mill and pest board officers to find out something of the habits, &c., of the particular rats with which they were dealing—i.e., of the rats which were found to be pests of cane. At an early stage the different kinds of rats were separated and were submitted for identification to competent authorities. Three species were found to be of interest to the cane farmer—viz., *Rattus rattus, Rattus culmorum,* and *Melomys littoralis.*

Unfortunately, at the present time, very little is definitely known about rat species in Queensland cane districts, other than the Herbert River, and knowledge of the wider distribution of some of the important species occurring there is very scant.

Rattus rattus (the House Rat) is a world-wide species but, as far as is known, it is not a very serious cane pest in Queensland. *Rattus norvegicus,* the species which is considered as being of considerable importance as a pest of cane in Hawaii, has not been reported, as yet, as damaging cane in Queensland, although it is present in cities of the State. The known locality records of *M. littoralis* are Cairns, Ingham, Innisfail, and Ayr. Specimens of *R. culmorum* have been identified from Ingham, Ayr, the Innisfail district, and from the Habana area of Mackay (November, 1935). At the present time this last-mentioned species, which is native to the country, is considered to be of the most importance to Queensland cane farmers. Under such circumstances it is very desirable that as much as possible should be known about its distribution, habits and characteristics, and the farmer should be able to distinguish it from other rats. As an aid towards these ends the following brief descriptions of some of the rats which may be found in cane in Queensland are set out below, together with the correct method for forwarding rat specimens to any of the Sugar Experiment Stations. Farmers are requested to do this as it will be of considerable help in increasing our knowledge of rats and their distribution in Queensland cane areas. Some species of the coast areas of Queensland had not been recorded since first found and described many years ago. Rats from both canefields and outside country are desired; if taken from canefields it is suggested that the specimens should be taken from spots not in close proximity to buildings.

* Reprinted from the "Cane Growers' Quarterly," by courtesy of Dr. Kerr, Director, Bureau of Sugar Experiment Stations.

Rattus rattus (the House Rat).

The total length of the head and body of a full-grown adult of this species is about 8 inches. Its colour is very variable. The fur is fairly soft but sparse and the lack of thick under-fur gives the coat,

Plate 116.
Tree-rat nest in Pandanus.

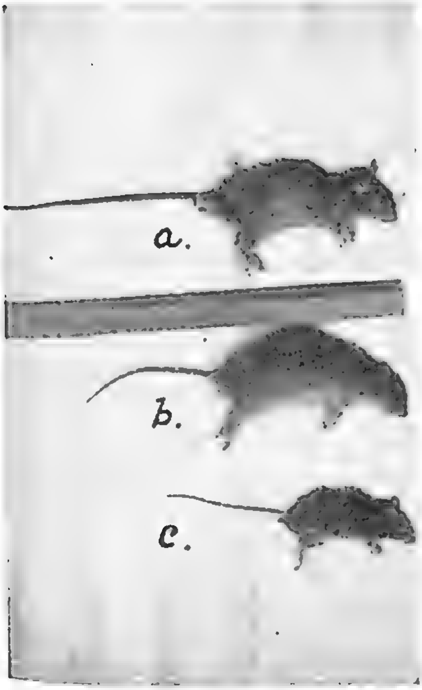


Plate 117.
(a) House rat (*Rattus rattus*).
(b) Field rat (*Rattus culmorum*).
(c) Tree rat (*Melomys littoralis*).

Plate 118.
Typical field rat burrow entrance under a cane stool.

[*Photos. after Gard.*

as a whole, a somewhat thin, harsh quality. The ears are large, almost free of hair, and leafy in appearance. This species can be distinguished from the others by its extremely long, slender tail which, when held

back over the body, reaches an inch or more beyond the tip of the rather sharp nose. Although known as the "ship" and "house" rat it is also found in the bush.

Rattus culmorum (the Coarse-haired or Spiny-haired Rat).

In the Herbert River district this species is called the Field Rat. It is usually smaller than the House Rat and the fur is much denser but rather coarse, and the presence of more or less numerous flattened spines gives the coat a harsh touch and appearance. The general colour, although variable, is dark-brownish flecked with lighter buff-brown. The sides are greyer and the belly is duff-white, often with a tinge of yellow, but never pure white as in some individuals of *Rattus rattus*. The muzzle is not as pointed as in the House Rat. The ears are short and practically naked. The tail when held back over the body reaches to about the shoulders.

Melomys littoralis.

This rat is called the "Tree," "Fruit," "Banana," or "Khaki" rat by farmers in the Herbert River mill areas. The last-named is a reasonably fair indication of its colour. In size it is much smaller and it is softer haired than the three *Rattus* species previously mentioned. It differs from them also in the number of teats; instead of 10-12 the female possesses 4 only. The main character of the genus Melomys is the almost naked tail with its patterned instead of ringed scales.

Preparation of Rat Specimens.

If "break-back" traps are being used the specimen should be collected as early as possible during the first morning of its death. Before it is placed in undiluted methylated spirits a slit of about 2 inches should be made along the centre of the belly of the dead rat. Specimens should not be crowded into receptacles (preferably air-tight) and they should be well covered with the preservative. After a week or more—i.e., when the flesh is well hardened—the specimens may be wrapped in some material, such as cotton wool or rags which will absorb spirits. Then the specimens, with wrapping well saturated with spirits, may be packed in leakless tins or other suitable containers for forwarding to the desired destination.

TREES ON THE FARM.

When a selector first obtains his license to occupy his newly acquired selection, his first objective is to fall the scrub, grass the land, and so make it revenue-producing as soon as possible. A commendable idea, but in his enthusiasm, the selector very often overlooks the fact that his stock will require shade in the summer and protection from cold winds in the winter. If every tree on the selection is cut down, neither shade nor shelter is available. As the summer approaches, cattle and horses look for shade, and in winter they seek shelter from the cold winds, but as the farmer has omitted to leave any trees standing, the cattle do a "perisher." As a consequence, the milk yield diminishes considerably and the cattle lose condition.

When clearing new land, it is always wise to leave a small patch of scrub standing here and there. If a complete clearance of timber has been made the advisability of planting a few weeping fig trees or other good shade trees on the farm shoud be considered. In ten years' time they will be quite big trees giving cool and ample shade to stock when summer comes. The planting of a few well-known timber trees in forest formation is also worthy of consideration.

Pineapple Disease.

A CAUSE OF POOR GERMINATION IN CANE.

A. F. BELL.

PINEAPPLE disease has not frequently been reported in Queensland, but particular attention was drawn to it some four months ago when it was an important factor contributing to the almost complete failure in germination of a sixty-acre planting in the Lower Burdekin district. It is possible that pineapple disease is responsible for considerably more bad strikes than are attributed to it; accordingly the symptoms

Plate 119.

A B

Pineapple disease of sugar cane produced by inoculation of setts. The lower part of A shows the general reddish discoloration of the flesh caused by the disease, while in B may be seen a good example of the sooty black core characteristic of later stages.

are described and illustrated here in order that the disease may be recognised and reported to our field officers when it occurs.

Pineapple disease is caused by a fungus which also causes the water blister of pineapples, while a similar fungus attacks the banana. At times standing cane may be attacked, but for the most part it is a disease of cane setts which becomes infected after they have been cut. The first symptom which can be seen is a light-red discoloration of the internal tissues or "flesh" of the cane (see Plate 119, A). Later, usually commencing at the cut surfaces, the colour changes to black, due to the production of the spores or "seeds" of the fungus. This black colour frequently extends into the inner joints in the form of a sooty core (see Plate 119, B). Perhaps the most striking symptom is the fact that when cut open many of the diseased setts give off a fruity odour very similar to that of a ripe pineapple.

Once the fungus has invaded the cane sett it soon penetrates to the buds and causes them to rot, thus prohibiting germination. Any condition which delays germination will tend to allow the fungus to enter and spread through the sett, destroy the eyes, and so ultimately prevent germination. Planting during weather which is too cool or too dry for a rapid strike, or placng too heavy cover on the setts, are among the conditions which tend to favour damage by this disease.

Considerable losses have been caused by pineapple disease, particularly in the British West Indies, where cane setts are sometimes soaked in Bordeaux mixture before planting as a means of control. Owing to its infrequently reported presence in Queensland, no control measures have heretofore been considered necessary, but investigations are being carried out at the present time in the pathology laboratory.

Plate 120.

THE ROAD MAKERS.—Wambo Shire: Darling Downs-Burnett Highway (Malakoff Road)—Cement penetration, flood section under construction.

COTTON.

THE rainfall experienced during the month in all of the cotton-growing districts, save in the south-eastern parts, has been of sufficient amounts to promote very satisfactory growth of the cotton plants. The earlier plantings are carrying good crops of well-developed bolls, and in some areas picking was in progress at the end of February. Given sufficient rainfall of moderate intensity during early March, it would appear that many growers will have excellent prospects of producing satisfactory yields.

The splendid progress that is being made by most of the cotton crops in all districts, save the south-eastern ones, where very limited rainfall has retarded development, indicates the ability of the cotton plant to produce satisfactorily under climatic conditions unfavourable for most other crops that can be grown economically in this State. Although appreciably delayed planting of the cotton areas was the general experience of most farmers this spring, and such adverse conditions ruled during the early summer as to seriously affect most farm crops, cotton has progressed very satisfactorily except in the outstandingly distressed areas, and the yields produced will contribute an appreciable portion of the returns that many farmers will obtain this season. Undoubtedly cotton-growing should occupy an important position in the crop rotation practised by many farmers of the main agricultural districts of this State.

SUGAR.

In all cane areas from Mackay northwards growing conditions in the cane areas during the month of February were generally favourable. However, no heavy rains had been received in the far northern districts, and the crops were beginning to suffer.

The drought situation in the southern areas was virtually broken by continued showery conditions during the month; and with a continuance of favourable weather conditions, a satisfactory crop may yet be produced in those parts.

WINTER FODDER CROPS IN SOUTHERN QUEENSLAND.

OWING to the abnormally dry conditions prevailing in the main farming areas during the spring and early summer months, it has been very difficult to establish summer fodder crops, and few have been fortunate enough to bring such crops to maturity.

Farmers should, therefore, take the opportunity of ultilising the large area available for the sowing of winter fodder crops in order to supplement natural pastures and replenish reserves. Under normal conditions the paddocks are prepared after the removal of early sown maize or summer fodder crops, and approximately two months are available to cultivate and fallow the land before commencing seasonal sowings during late March. A thorough ploughing, cross-ploughing, disc or tine cultivation, and harrowing will form a suitable seed-bed on average soils. Succession sowings can be made during April and May if desired, while if seasonal rains are delayed sowings can be extended to early July with reasonable prospects of securing good grazing for a limited period.

Statistics show that an area of oats approximately 100,000 acres in extent is sown annually in Queensland for grazing and green fodder purposes, with smaller areas of wheat and barley used in the same way. These cereals can be combined, with legumes such as field peas, vetches, or tares, thereby providing a richer and more balanced ration.

Drilling methods of planting are preferable, as the seed can be placed at the correct depth. In the absence of suitable machinery, broadcasting is generally practised, sowing the legume first and discing or cultivating in, following with the cereals, which are broadcast and harrowed in.

Of the varieties utilised, Florence, Warren, or Warchief wheat, Sunrise Belah, or Algerian oats, and skinless barley, have proved suitable. Florence wheat 30 lb. and Dun field peas 20 lb. has proved a suitable mixture, as both are fairly early maturing. Algerian oats 30 lb. and vetches or tares 20 lb. per acre is also a suitable combination, being somewhat slower maturing than the former. The earlier maturing varieties of oats, such as Belah and Sunrise, may also be sown with field peas if desired.

Besides adding to the value of the forage, the addition of a legume provides an excellent rotation crop of considerable benefit to the soil.—H. W. BALL, Assistant Experimentalist.

THE FUNGICIDAL TREATMENT OF SEED POTATOES.

Seed potatoes showing the presence of either common scab or black scurf should be treated with a fungicide before planting, otherwise, given the necessary weather conditions, considerable damage may be done by one or both of these diseases to the resulting crop. Two methods are available for the purpose. One employs hot formalin solution and the other acid corrosive sublimate. The latter is more convenient, as no heat is required. The potatoes should be washed but not cut before treating.

Prepare the formalin solution by mixing 1 pint of commercial formalin (40 per cent. formaldehyde) with 15 gallons of water. Heat to 125 deg. Fahr. and arrange for maintaining the temperature at this point by building a small fire under the tank or by keeping some of the

solution hot in a boiler so that a little of this may be added from time to time as the rest cools. No more than a 5 deg. variation in temperature either way during the operation should be allowed. Dip the seed tubers into the solution for two and a-half minutes in successive small quantities in crates or upon sacks. Remove, and after draining excess solution back into the tank, cover the potatoes with bags or canvas for one hour to keep in the formalin fumes. Finally spread out to dry before planting.

The acid corrosive sublimate solution is prepared by adding $\frac{1}{4}$ lb. of corrosive sublimate and $1\frac{1}{4}$ lb. of hydrochloric acid (spirits of salts) to $12\frac{1}{2}$ gallons of water. A wooden or well-painted vessel must be used, as this mixture corrodes metal. When all the corrosive sublimate has dissolved, immerse the tubers (in lots of convenient size) for five minutes, and then spread out to dry. The dipping is preferably carried out in wooden crates rather than bags. The solution loses its strength gradually, so that a fresh quantity should be made up after ten successive lots have been treated.

Acid corrosive sublimate must be used on dormant tubers and not on ones which have sprouted, otherwise some injury or delay in germination may occur. Treatment may be carried out three or four months before planting. Corrosive sublimate is a deadly poison and must be used with care. All treated tubers must be planted or buried to avoid the possibility of their being consumed by any person or domestic animal. The solution may cause some irritation to the hands unless they are greased well before immersion.

These treatments are only effective if the soil on which the crop is grown is free from the parasitic fungi causing the diseases. It is of little use treating seed to be planted in land which has borne a badly diseased crop of potatoes within recent years.—J. H. Simmonds, M.Sc., Senior Pathologist.

JERUSALEM ARTICHOKE.

Like the sweet potato, Jerusalem artichoke is a crop which should receive much more attention than it does at present, more particularly by those engaged in pig-raising in the western farming districts, for not only is it highly drought-resistant but its tubers are highly nutritious as well. The yield, which is controlled by the soil and seasonal conditions, may range from 300 to 500 bushels or more per acre, and although the plant does best on good friable loams, it will thrive on sandy, gravelly, or clayey soils, which enables the poorer patches of soil on a farm to be put to a profitable use.

The area intended for its reception should be prepared in much the same way as if it were intended for potatoes. It may be planted in early spring in furrows three feet apart, with the sets two feet apart. This spacing with medium-sized tubers will entail the use of between 4 and 5 cwt. per acre.

As with maize and potatoes, until the crop is 4 inches high all cultural operations can be carried out with tined harrows working across the drills. Afterwards the cultivator will have to be used, as the condition of the soil and weed growth necessitates.

When the tops die, the crop is fit for harvesting, which can be accomplished most profitably by turning pigs on to the field. If it is intended to plant the same area in the succeeding season, it will be necessary to remove the pigs before all the tubers have been eaten, if replanting is to be avoided. The area should be cultivated in the spring. Subsequent working will be similar to that of the first season. The white and red varieties are considered to be the most hardy and prolific.—R. Soutter, Agricultural Research Officer.

PASSION FRUIT GROWING ON THE SOUTH COAST.

J. McG. WILLS, Fruit Branch.

[*Continued from page 209, February, 1937.*]

SELECTION OF SITE.

THE site for the vineyard should be carefully chosen. Here are six important factors to be considered before making the final selection:—

1. Aspect;
2. Elevation;
3. Shelter;
4. Soil;
5. Drainage;
6. Accessibility.

Aspect, elevation, and shelter in many instances will go together, as a good aspect is often elevated and sheltered by higher ground at the rear.

Secure, if possible, an aspect open to the early morning sun, backed by good solid natural growth or rising land to provide protection from strong winds. The site should also be sufficiently high above sea-level to escape the frosts. It should be sheltered from all cold winds, particularly those from the south and west, and for preference should have an aspect of from east to north. Such an aspect is naturally warmer and well protected, thus exerting a marked influence on the early maturity of the vines and the production of large crops of high-grade fruit which colours and ripens evenly and more rapidly than fruit grown in vineyards less favourably situated. Avoid the tops of ridges even when they have the desired aspect, as the soil may have been badly washed, leaving a low humus content. Vines rarely grow vigorously when planted on such sites.

Situations so heavily timbered that the free movement of air is prevented or seriously restricted should not be considered, unless provision has been made to allow the cold air to pass down the lower levels; otherwise frosting or severe chilling may result.

While the passion fruit vine is not very exacting in its soil requirements and will establish itself rapidly on most of our coastal soils, good natural drainage is absolutely essential. Any situation which may possess all the other qualifications will be unsatisfactory if lacking in natural drainage, for the vines will eventually fail, as stagnant water and sour soil conditions are absolutely fatal to their development. The best type of soil for passion fruit growing is more or less a matter of divided opinion. Vines have been grown successfully on many classes of soil ranging from rich vine scrub to poor forest and coastal sand. Provided the soil is put in a good mechanical and physical condition and is not underlaid by any impervious clay subsoil, the vines appear to establish themselves rapidly and flourish, eventually producing crops of good-quality fruit. It is generally acknowledged that good vine scrub soil is richer than forest soil, and tends to produce heavy foliage on the vines; also there is a tendency for the vines to produce a more rank, vigorous growth, which becomes rather a disadvantage in that extra work is entailed keeping the growth in check and combating fungus diseases to which the vine is subject.

Plate 121.

New land prepared for further planting. Established area adjacent. Russell Island, Moreton Bay.

Good forest land will produce a vine of good average growth without the tendency to excessive production of wood growth, while the cropping propensities of the vine are nearly equal to that of vines grown on scrub lands—a distinct advantage, as there is less trouble and cost in controlling the vine growth and combating fungus diseases. In good forest country a retentive subsoil is also a distinct advantage. Normally, forest soils do not possess as great an amount of organic

Plate 122.

The entrance to Canaipa Passage, Stradbroke Island in the background. The launch is engaged in regular inter-island transport, in which passion fruit makes up a large proportion of consignments, in Moreton Bay.

matter as scrub soils; consequently it is impossible for forest soil to absorb and retain sufficient moisture to meet the demand of a heavy crop in very dry seasons.

Forest soils require considerably more working in order to bring them into a satisfactory physical condition, as they are seldom as deep or friable as scrub soils.

Plate 123.

An established passion fruit vineyard at Springbrook on one of the numerous small, richly fertile plateaux of the Macpherson Range, bordering New South Wales in the south-eastern sector of Queensland.

Very heavy types of soil should not be planted with passion fruit, as the natural drainage is usually poor; while soils having a heavy clay subsoil close to the surface should be left out of consideration.

In common with the banana, passion fruit does well on stony ground, and the presence of surface stone or "floaters" is not detrimental, provided the body of soil is sufficient. Where the surface is stony, cultivation costs will obviously be increased. However, this disadvantage is offset by the prevention of surface soil erosion, retention of soil moisture during dry periods, and the maintenance of a higher soil temperature during winter. This higher soil temperature during the cold months maintains the plants in a more vigorous growth, resulting in a more rapid response to spring conditions and, generally, more satisfactory conditions throughout the year.

Drainage.

As mentioned elsewhere, the passion fruit vine will not thrive under excessive wet or sour soil conditions, stagnant water being absolutely fatal to the plants. Throughout the South Coast there is a very high rainfall, and during normal wet seasons half the annual rainfall may be precipitated during two to three months; therefore the need for adequate natural drainage is obvious. No matter how rich the soil may appear to be, if it is sour or badly drained it should not be planted, unless satisfactory provision can be made to improve this condition by effective drainage, thus lowering the watertable beneath the depth—at least 2 feet—required by the roots of the plants.

High land has the advantage of being drained sufficiently and naturally to cope with even the wettest periods of the rainy season, without permitting wet soil conditions to develop to such an extent that any harmful effect will be noticed on the vines.

The soil should be well broken up to a depth of at least 6 inches and the surface afterwards maintained in a good cultural condition. As a safeguard against surface soil erosion, contour drains should be constructed across sloping land. These drains should be as short as convenient, with a slight fall in order that the rain run-off will not flow too rapidly or with the strengthening volume force of water that occurs in steeply-graded channels.

On flat land where natural drainage is at all faulty, consideration must be given to the construction of deep main drains at regular intervals, into which a series of shallower drains will carry excess water. If this is not possible, through financial or geographical limitations, then the site should be abandoned.

Accessibility.

The method of cultivation used will be decided mainly by the contour of the land. Mechanically or horse-drawn cultivators, where they can be used, are more economical than man power. The presence of logs, stumps, boulders, stony and uneven surfaces all increase the expenditure of time and labour in the performance of cultural operations, as so much work must be done by hand.

On sloping land the packing shed should be erected in such a position that a wiring system can be installed conveniently. By this means fruit can be quickly and safely despatched from numerous suitable positions in the vineyard, so greatly reducing harvesting costs. The location should be, if possible, within reasonable distance of a railway siding or other suitable forwarding centre.

If the fruit has to be conveyed many miles by truck a good road is necessary; otherwise delivery may be interrupted by floods or the roads becoming impassable for several days during wet weather.

It is advisable to fix on a situation from which the fruit can be despatched uninterruptedly, as the daily despatch of fruit to the market is most desirable and any disorganisation of transport may result in heavy loss to the grower.

[TO BE CONTINUED.]

FRUIT MARKETING NOTES.

JAS. H. GREGORY, Instructor in Fruit Packing.

GENERALLY, the market has been firm for all fruits during the last few weeks. Many of the coastal fruits are only beginning to show the effects of the prolonged dry spell.

Stone Fruits.

Plums.—Local supplies have now practically ceased. New South Wales plums—Ponds and Grand Duke—are realising 5s. to 8s. per case, some fine quality coming on to the market.

Peaches.—Stanthorpe peaches are realising 2s. to 5s. per half-bushel for good-quality fruit. The season is now drawing to a close. Supplies have not been as heavy as usual, and prices have remained firm. Victorian peaches, 9s. to 13s.

Grapes.—Excellent fruit has been available throughout the season. Prices have remained firm, with Muscats and Walthams most popular. Prices per half-bushel case: Waltham Cross, 5s. to 7s.; Muscatels, 4s. to 5s. 6d.; Black Prince, 3s. 6d. to 4s. 6d.; Colemans, 3s. 6d. to 4s. 6d.; Hamburgs and Ascots, 3s. to 4s.

Apples.—The demand for cookers and Granny Smiths has eased owing to the prevalence of green fruit on the market. Some excellent Jonathans have been seen, and obtained good prices. Jonathan, 6s. to 9s.; Granny Smith, 6s. to 8s.; Delicious, 6s. to 8s.; King David, 4s. to 8s.

Pears.—Only choice-quality pears were popular, poor lines being hard to move; 4s. to 6s. per case being top prices, with an occasional extra special line at 7s.; Victorian and New South Wales, 8s. to 9s.

Export Consignments.

Apple export consignments are now in full swing. Care is necessary if consignments are to arrive in good condition. Close attention should be paid to labels, &c., in order to ensure that the general get-up is as

near perfect as possible. Attach labels securely. If the label becomes unattached, the fruit loses its identity and trade description. Place labels on squarely. Do not pencil in particulars. It is not permitted, and in any case is only a third-rate method of doing things. Wiring should be carried out with care, so that no undue pressure is brought to bear on the fruit. Keep the wires at the ends of the cases. Stencil cases neatly and cleanly.

These are little points noted at the ship's side which spoil the perfection of many consignments.

Tropical Fruits.

Pineapples.—Heavy supplies are coming to hand, and prices have eased. The position is being complicated by the high percentage of sunburned fruit sent on to the market. Prices: Brisbane, cases, 2s. to 5s. for Smooths; loose, 6d. to 3s. per dozen; Ripleys, 4s. to 6s. 6d.; loose, 6d. to 3s. per dozen. Sydney, Smooths, 6s. to 9s. Melbourne, Smooths, 8s. to 10s. Many lines have arrived in leaking condition. Some lines are also green. Water blister has been noticeable.

Bananas.—Supplies have been maintained, fruit generally being still on the thin side. November dumps are now making their appearance in increasing quantities. Prices: Brisbane, Sixes, 7s. to 11s. 6d.; Sevens, 7s. to 12s. 9d.; Eights, 8s. to 13s. 6d.; Nines, 8s. to 14s. Sydney, Sixes, 11s. to 13s.; Sevens, 12s. to 14s.; Eights and Nines, to 17s. Melbourne, Sixes, 12s. to 13s.; Sevens, 13s. to 15s.; Eights and Nines, 15s. to 16s.

Prices are inclined to show a downward trend. Many lines have been marked down in grade; growers should take every care to keep up to the grade. The smallest fruit in the case should indicate the grade, and the case should be marked accordingly.

Mangoes.—It has been an excellent season for quality mangoes. Supplies are now diminishing. Prices: 4s. to 5s. for commons; special varieties higher.

Papaws.—Supplies are short, prices being maintained at high levels. Brisbane prices: Locals, 5s. to 6s. per bushel; Yarwun, 10s. to 11s. per tropical case. Sydney, 12s. to 16s. tropical case.

Passion Fruit.—Supplies are now plentiful; for average lines 4s. 6d. to 5s., and for specials to 7s. are the prevailing prices on the Brisbane market.

There are some excellently packed lines obtainable, but one still sees the old haphazard "throw them in" methods in use. It pays to pack this fruit. Sydney, 6s. to 12s. per half-bushel. Melbourne, 4s. to 7s.

Citrus Fruits.

Lemons.—Lemons are still maintaining exceptionally high rates on the Brisbane market. Gayndah and Benyenda, 20s. to 21s. per case; small and second grade, 10s. to 16s.; Locals, 14s. to 16s.; Victorian, 13s. to 16s. Melbourne, 6s. to 16s. Sydney, 6s. to 14s.

Oranges.—No local supplies available, New South Wales realising 9s. to 13s. Sydney, Valencias, 6s. to 11s. Melbourne, Valencias, 6s. to 16s.

Grape Fruit.—No local supplies are yet on the market. Early consignments should attract good prices, particularly in Melbourne, where 14s. to 30s. is the present price for imported fruit. Some special selected fruit realised up to 40s. for the 1½-bushel citrus export case.

Tomatoes.—Market demand steady for good tomatoes in Brisbane, good coloured lines selling to 7s. Ripe fruit, 3s. to 6s.; green, 3s. to 5s.

Sydney quotes Queensland tomatoes from Stanthorpe 3s. to 5s. Local supplies, 4s. to 7s.

Miscellaneous Fruits.—Rock Melons, Brisbane prices, Stanthorpe, 3s. to 5s. a bushel case. Quinces, 2s. to 3s. per case. Monstera, Brisbane, 4d. each; Melbourne, to 1s. each; Figs, 4s.; special boxed dessert, 9d.

General.

Banana growers are requested to watch for a change in packing methods with the introduction in New South Wales and Queensland of the cluster pack. A bushel container is also to be introduced. Experiments over three years indicate that better marketing conditions will prevail with the adoption of the contemplated changes.

Plate 124.

THE ROAD WINDING EVER UPWARDS.—The new Nerang-Beechmont road replaces a narrow mountain track shown near the right of the picture.

The Tropics and Man

TEMPERATURE, HUMIDITY, AND AIR-MOVEMENT.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology, University of Queensland.

No. 3.

AT the close of the last article, you will remember, I pointed out to you that the difficulties the human body had to contend with in getting rid of its surplus heat were bound up with the three climatic factors of temperature, humidity, and air-movement. These three are so important that, in spite of my assurances last time, I am going to discuss them separately a little more fully before passing on to Queensland climates in particular.

Heat Factors in Climate.

There is no need to delay over the factor "temperature." Everyone knows that the unqualified word "temperature" refers to the reading given by a naked dry mercury thermometer, and that when the meteorologist speaks of temperature, he refers to the reading made with this thermometer in a standard box with louvres, and thus shaded from the sun. There are other kinds of temperature readings, such as wet-bulb, sun, and ground temperatures, but these have special meanings and are not usually confused with the ordinary "temperature." As I indicated in the February Journal, the temperature of the body's surroundings is important, because, other things being equal, the loss of heat from the body by radiation and conduction depends upon how much cooler these surroundings are than the human body. If, as sometimes happens in desert climates, the surroundings are hotter than the body, the body gains heat instead of losing it by these paths.

Humidity probably requires a little more description. Everyone knows that it means the moisture in the air, but few realise its exact meaning or the fact that its measurement is now of great importance in comparing climates one with another. The term "absolute humidity" is not of much use in climatology; so just note it in order to avoid confusion if it crops up at any time. The term "relative humidity" is of great use, however. It is a comparison between the amount of moisture the air actually is holding and the amount of moisture it could hold at the same temperature. On the western plains the relative humidity is usually 20 per cent.—i.e., the air contains only one-fifth of the moisture it could hold if given the opportunity. On the coast, the relative humidity lies between 60 and 80 per cent., so that it can take up much less extra water vapour than inland air. Evaporation will, of course, go on much more readily when the relative humidity is low than when it is high. Clothes and perspiration dry very much more quickly in the interior than on the coast.

How is this relative humidity measured? In the first place, of course, it was measured by the cumbersome process of extracting all the water from the air and measuring it, and then seeing how much water the perfectly dry air would take up when given full opportunity. Men soon found out, however, that the reading given by an ordinary

thermometer wrapped in wet lint had an important relation with relative humidity. Now all the meteorologist does is to read the ordinary (dry bulb) thermometer and this wet bulb thermometer, refer the readings to a standard table, and read off the result. All perfectly easy, but what of the men who worked out the table in the first place?

It is because the "relative humidity" determines how quickly water (or sweat) will evaporate at a particular temperature that it is so important to us. On dry days sweat can evaporate very readily and thus help tremendously in cooling the body (or in over-cooling it if we are foolish enough to let it get the chance), but on wet days sweat evaporates slowly and is a much less efficient servant.

Air-movement is, of course, a most familiar thing, and a very welcome visitor in hot, steamy coastal regions. Its contribution to comfort lies in removing the layer of air in contact with the skin which has become loaded with heat and moisture, and replacing it with cooler and drier air to which the body can give away more heat and more moisture. If the air is very dry, a very small amount of air-movement will suffice to ensure evaporation of all skin moisture, but the more humid the air the greater the air-movement required. As long as the air is cooler than the skin, increased air-movement will increase heat-loss; but when the air is hotter than the skin, increasing the air-movement will increase heat-absorption of the body. For these reasons, air-movement is very much more valuable in hot humid climates in which the temperature is seldom higher than that of the body, and humidity is high, than in hot arid regions, where temperatures are often higher than that of the body, and humidity is low.

The Measurement of Co-operative Effect.

A suspicion has probably arisen in your minds by this time that if these three factors of climate all interfere in some way with the loss of heat from the body, and if they can all be measured and dealt with intimately by prying scientists as the technical jargon you have been reading suggests, there ought to be some method of dealing with them on a common footing and of expressing their combined result in some simple measurement that all can appreciate. Now that idea, believe it or not, occurred to some of these technically-minded scientists, and attempts were made to devise some formula which would be true to facts and yet yield some simple method of assessing the net effect upon heat-loss from the body of any given set of atmospheric conditions. Two very interesting and important results were developed. The first was evolved by Leonard (afterwards Sir Leonard) Hill and his colleagues in London towards the end of the war, whilst investigating conditions in war-time industry. This was a special instrument known as the kata-thermometer, which, instead of measuring temperature, measured the rate at which it lost heat in a given atmosphere. This was very good, and could be made to imitate a clothed or naked, a wet or dry body. It possessed certain disadvantages, however, which prevented its universal adoption. It is now used chiefly as a sensitive instrument for measuring variable small air-movements, for which purpose it remains very valuable. The most practical scheme was developed in America by Houghten, Yagloglou (the Americans soon shortened this to Yaglou), and others. These workers had two rooms in which they could produce any combination of temperature, humidity, and air-movement they desired. They performed many thousands of experiments in which

human subjects were placed in one room until they got used to it and then transferred to another room and asked whether they felt hotter or colder. These experiments involved an enormous amount of work and took a long time to complete, but the results were very much worthwhile. From the enormous number of answers they were able to plot out a somewhat complicated diagram (what engineers call a nomogram) in which these three factors could be conjointly assessed. They then coined the term "Effective temperature"—a term which has come to stay. The *effective temperature* of an atmosphere is the temperature at which a still atmosphere saturated with water vapour would have to be in order to have the same general effect upon the body. Let me illustrate this difficult definition with an example. An atmosphere with (dry bulb) temperature 76 degrees, wet bulb temperature 62 degrees, and wind velocity of 100 feet per minute would have the same general effect upon the human body as a saturated still atmosphere with (dry bulb) temperature 70·2 degrees. The *effective temperature* of the first atmosphere is, therefore, 70·2 degrees. Again, an atmosphere at 110 degrees dry bulb temperature, 90 degrees wet bulb temperature, and no air-movement would have the same general effect as a saturated still atmosphere with 94 degrees dry bulb temperature; its *effective temperature,* in other words, would be 94 degrees. By means of this scheme, therefore, it is possible, with some degree of accuracy, to compare one set of atmospheric conditions with another, *in so far as they affect the human body.* One notes the dry and wet bulb temperature and the wind velocity of each atmosphere and determines the "effective temperature" of each from the standard chart. These "effective temperatures" mean something comprehensible and can easily be compared. In the next article I shall show you how the climates of different parts of Queensland can be compared, one with another, by means of this scheme, and assessed in respect of their general effects upon the human body.

[*Next issue: "The Climates of Queensland."*]

SHELTER FOR PIGS.

Protection from the extremes of weather is essential for the health and economical growth of pigs. During hot weather it is obvious to the observant pig raiser that pigs require cool shade and they even enjoy a bath in a wallow or muddy pool. A number of pigs die each summer from headstroke, which affects the fatter pigs and those which are deprived of cool shelter.

Whilst the wallow is a means of cooling pigs, it is a probable source of infection unless it is well constructed of concrete and capable of being emptied and cleaned frequently. The wallow should also be covered with a roof or a tree to protect pigs from the sun while bathing.

Cool shade can be provided for pigs by the ordinary shelter sheds as recommended in the department's bulletin on pig accommodation, provided the sheds are constructed with the roof not less than 6 feet from the floor at the lowest part, and provided there is a ventilation space of at least 6 inches between the top of the walls and the roof. The front should be at least partly open and the shed faced to the north-east; this latter provision allows the direct sunrays to enter the shed in the early morning, acting as a disinfectant, then, as the temperature increases later in the day and the pigs require shade, the sunrays are on the northern and western walls of the shed, thus leaving the interior shady for the pigs.

A supply of clean, cool drinking water will also help to keep pigs comfortable in hot weather.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of January, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Nancy 14th of Springdale	J. Phillips, Sunnyview, Wondai	17,753·3	707·133	Lovely's Commodore of Burradale
Honey 8th of Sunnyside	P. Moore, Wooroolin	12,303·2	499·083	Bruce of Avonel
Kyabram Myrtle	A. H. E. Black, Kumbia	11,872·4	467·916	Ledger of Greyleigh
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD, 250 LB.			
Myrtle 2nd of Sunnyview	J. Phillips, Sunnyview, Wondai	13,213·8	523·014	Burradale Byron
Mabreen Honeycombe	V. Dunstan, Mabreen, Wolvi, Gympie	8,418·95	335·174	Numbawarra Headlight
Burradale Favourite 8th	A. H. E. Black, Kumbia	7,570·3	326·237	Burradale Banner
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.			
Mabreen Nancy	V. Dunstan, Mabreen, Wolvi, Gympie	9,008·75	343·801	Numbawarra Headlight
Mabreen Gem	V. Dunstan, Mabreen, Wolvi, Gympie	8,062·3	297·861	Numbawarra Headlight
	JERSEY.			
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD, 230 LB.			
Oxford Lady Daffodil	E. Burton and Sons, Wanora	5,231·05	314·13	Oxford Golden Lad
Kathleigh Model	D. Young, Kingaroy	5,429·3	310·045	Retford King's Thorn
Bellgarth Bonzanette II.	D. R. Hutton, Cunningham	4,863·5	274·169	Trecarne Renown II.
Kathleigh Royal Butterfly	J. Goostrey, Bald Knob, *via* Landsborough	5,963·9	320·999	Retford Royal Atavist
College Goldspray 3rd	Queensland Agricultural High School and College, Gatton	5,395·26	258·636	Burnside Defender

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Swamp Millet.

G.L. (Twin View, Elimbah)—

The specimen represents *Echinochloa Walteri,* sometimes called swamp millet, a native grass generally regarded as excellent fodder. It is very closely allied botanically to such well-known cultivated crops as Japanese millet and white panicum. Seed is not stocked by nurserymen, but the plant grows naturally along creek banks and in swampy places, generally in coastal Queensland, and once introduced usually spreads naturally in such localities.

Wild Sorghum.

G.H. (Mount Larcom)—

The specimen represents a species of wild sorghum, *Sorghum verticilliflorum,* a native of South Africa, but now widely naturalised in Queensland. It is rather a caney grass, and like other sorghums contains a prussic acid yielding glucoside. As a matter of fact, it contains more of the glucoside than most of the other sorghums growing in Queensland. On this account, if it is fed to stock, particularly to hungry stock, a certain amount of care should be exercised and the cattle prevented from gorging themselves on it. Preferably, it should be cut and allowed to wilt before feeding.

Mimosa.

D.D.L. (Kilcoy)—

The pods represent those of the mimosa bush, *Acacia farnesiana.* This is the same species that grows in Western Queensland. On the coast or near-coast, a few bushes are occasionally seen in paddocks or along creek banks. We are not sure if they are growing wild in such places, or if they have escaped from cultivation. The leaves are valuable sheep food, but occasionally we have heard of stock refusing to eat them. This, however, is rather unusual. The pods in a greener state than those you sent should be quite good fodder, particularly for sheep. We doubt if there will be enough leafage on the plant to worry about cattle.

Convolvulus. Ruellia.

R.C. (Mundubbera)—

1. The creeping plant or vine is *Convolvulus erubescens,* sometimes called the small convolvulus or morning glory. It is a very common plant throughout a good deal of Western Queensland and often seen right to the coast. As you mentioned, it is quite a good fodder, but these convolvulus vines sometimes cause impaction through their running, fibrous stems, particularly when old.
2. The smaller plant is *Ruellia australis,* a very pretty little native herb fairly common in many places for which we have not heard a distinctive local name. The generic one, Ruellia, however, is short enough for general usage.

Polygonum.

J.McK. (Boompa)—

The specimen is the oriental smart weed, *Polygonum orientale.* This is a fairly common plant in Queensland and usually grows in rather wet or badly drained situations. So far as we know, it has not previously come under suspicion as a poisonous plant, but smart weeds or species of Polygonum are known to cause trouble among stock. A symptom of poisoning by Polygonum is generally an inflammatory swelling of the ears, face, and eyelids. This affection is generally accompanied by itching, causing rubbing, shaking, and scratching of the head.

Yellow Plum.

S.E.S. (Cairns)—

We do not think there is any doubt that it is the Yellow Plum, *Ximenia americana,* a shrub that is fairly widely spread over the coasts of the Pacific in addition to North Queensland. In Queensland, it not only occurs right on the coast and sometimes a considerable distance inland. The fruits are edible but the leaves contain a prussic acid yielding glucoside and have been known to cause the death of goats that have browsed on it.

Carpet or Mat Grass.

W.D.B. (Yandina)—

(1) *Axonopus compressus,* carpet or mat grass, broad-leafed form.

(2) *Axonopus compressus,* carpet or mat grass, narrow-leafed form. These two forms are rather distinct as they occur in Queensland, but botanists generally regard them as the same species. As you know, there has been a good deal of controversy about carpet grass along the North Coast. There is no doubt that this grass is beneficial on second-class country, and in such places some dairymen and stock-raisers speak quite well of it. The common trouble with it is that it invades the ordinary paspalum country and other better class pastures, very much to their detriment. It is not a new grass along the North Coast, as it has, to our knowledge, been there for over twenty years. Probably the heavier stocking and thinning out of the paspalum pastures has given it a chance to invade them and increase.

(3) This specimen bore no seed heads, but we should say it was either an intermediate form between Nos. 1 and 2 or else simply a form of No. 1. If a few seed heads could be found we would much like to have them.

Blue Top.

P.McM. (Ballandean)—

The specimen is the blue top heliotrope, *Heliotropium anchusaefolium,* a native of Brazil and the Argentine that has now become rather a serious pest in parts of the Darling Downs particularly and in other parts of Queensland. It is not known to possess any poisonous properties. The plant was probably introduced originally as a garden plant and has been naturalised on the coastal lands for many years past, but on the coast it does not seem to be so aggressive as it is on the Darling Downs.

If you have a small patch the only plan is to keep it cut off below the ground level regularly so that the roots will eventually become exhausted by sending up numerous shoots. If, of course, they are allowed to get to a fair size the leaves nourish the roots and growth keeps on. The main object is to make the roots exhaust themselves by sending up new shoots and, as these appear, cutting them off. This means, of course, regular work on the plot about once a month. Any of the common weed sprays could be used, but with plants of this type they have to be applied several times before the roots exhaust themselves.

Wild Setaria.

H.P. (Stanthorpe)—

The specimen is *Setaria glauca,* pigeon grass or wild setaria. This grass is very widely spread over the warm temperate countries of the world and is fairly common in Queensland, mostly as a weed of cultivation or growing in rather damp places. It does not seem to invade the ordinary pasture to any extent. It is quite a good grass and is very closely allied to the cultivated setarias, giant setaria, dwarf setaria, panicum, Hungarian millet, &c.

"Early Spring" Grasses. Scented Top.

G.N.H. (Didcot)—

(1) *Eriochloa* sp. Species of Eriochloa are generally looked upon as excellent fodders. They are mostly known as early spring grasses, a not very appropriate name, for they are no earlier than many other grasses which come up with the early summer rains. The genus is at present under revision and we cannot give you a specific name for the particular one you send.

(2) *Capillipedium parviflorum,* scented top, a very common grass, particularly in much of the forest country of coastal and sub-coastal Queensland. It is generally regarded as quite a good cattle grass in such situations.

General Notes

Staff Changes and Appointments.

The appointment of the Officer in charge of Police at Goondiwindi as acting Inspector of Stock has been cancelled.

Mr. A. E. George, Court House, Ingham, has been appointed chairman of the Victoria and Macknade Local Sugar Cane Prices Boards, and also an agent of the Central Sugar Cane Prices Board for the purpose of making enquiries under section 5 (2A) of the Regulation of Sugar Cane Prices Acts in regard to sales and leases of assigned lands, vice Mr. C. B. Buxton, transferred.

Mr. R. A. Taylor, Inspector and Examiner under the Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers, and Stock Foods Acts, has been appointed also an expert under the Pure Seeds Act, during the absence at any time of the Officer in Charge, Mr. F. B. Coleman.

Mr. R. W. Greville (Lane Cove, Sydney) has been appointed Assistant Veterinary Surgeon, Department of Agriculture and Stock.

Mr. R. J. F. T. Wust, Government Teacher at Poid, Moa Island, via Thursday Island, and Mr. G. A. Frusher, Government Teacher at Saibai Island, via Thursday Island, have been appointed honorary rangers under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. D. O. James (Babinda) has been appointed canegrowers' representative on the Babinda Local Sugar Cane Prices Board, and Messrs. P. E. Nielsen (Septimus, Mirani) and T. F. Ross (Oakenden, Eton) have been appointed canegrowers' representatives on the North Eton Local Sugar Cane Prices Board.

Mr. F. Moore, Double Island road, Cook Highway, has been appointed an honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. V. J. Anderson, Acting Clerk of Petty Sessions, Childers, has been appointed chairman of the Isis Local Sugar Cane Prices Board and an agent of the Central Sugar Cane Prices Board during the absence on leave of Mr. L. H. Roles.

Northern Pig Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Northern Pig Board in regard to the furnishing of information and returns by growers and covering any prosecutions for offences.

Tobacco Pure Seed District—Central Queensland.

An Order in Council has been issued under "*The Tobacco Industry Protection Act of* 1933" altering the boundaries of the Tobacco Pure Seed District in the Marmor, Bajool, Archer, and Nerimbera districts, by including therein the parishes of Bouldercombe, Gracemere, and Barmoya.

Barley Board.

An Order in Council has been approved under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Barley Board by declaring the class of persons who shall be deemed to be growers of barley and eligible to vote at any referendum or poll in connection with barley.

Formerly, a voter was a person who harvested barley during the preceding twelve months. The amendment provides that persons eligible to vote shall be those who at any time during the two years preceding the date of a referendum or poll—

(*a*) delivered their barley to the Barley Board;

(*b*) furnished to the Board a return in respect of barley planted by them during any of those years for delivery of the resultant grain to the Board; or

(*c*) established to the Board's satisfaction that they have planted barley for delivery of the grain to the Board and have failed to obtain a marketable crop therefrom.

Atherton Tableland Maize Board.

An Order in Council has been issued in pursuance of the provisions of "*The Primary Producers Organisation and Marketing Acts*, 1926 *to* 1935," amending the constitution of the Atherton Tableland Maize Board in regard to the furnishing of information and returns by growers to the Board, and covering any prosecutions for offences.

Rural Topics

Banana Planting.

At this period of the year banana-growers are seriously considering their source of planting material, for the time is almost at hand when the very important operation of planting must be commenced.

Various opinions are put forward as to the best class of plants to use, and under certain conditions most of these opinions, if carried out, are capable of producing satisfactory results. The following is a brief description of each:—

Sucker—Should be selected from a vigorous, healthy stool, the actual sucker selected being about 18 inches high, and having a big, strong, clean corm of at least 6 inches in diameter.

Butt—Should be selected from a vigorous, healthy stool, and trimmed so as to allow not more than two eyes to come away. When trimmed a butt plant should measure about 7 inches in diameter and 6 inches deep.

Bit—Should be selected as in the case of the butt, and in reality is a suitable section of a selected butt.

When weather conditions run awry, and lack of rain makes banana-growing somewhat difficult, the butt plant should be easily a first choice on account of its resistance to the harder conditions.

Lantana country, burnt and grubbed, is ready to hole out and plant; scrub country, burnt, logged up if necessary, and holed out, is also ready to plant; but forest country needs digging up to a depth of at least 6 inches before holing and planting.

Planting 10 feet by 10 feet is to be recommended, and big holes are always an advantage; 15 inches square by 12 inches deep, or even larger, are the measurements suggested for the guidance of prospective planters.—J. H. FREEMAN, Senior Instructor in Fruit Culture.

Curdled or Cheesy Milk—Importance of Cooling.

Recently a sample of milk was examined at the Dairy Research Labratory, which had coagulated or curdled when only a few hours old. Through the co-operative action of microbes the curd had become flaky or lumpy, due to disturbance by rising bubbles. It was not appreciably sour, but had a cheesy odour, and the phenomenon was found to be due to an action resembling that of rennet (similar to the action of junket tablets in milk).

Milk which has been curdled by rennet generally turns cheesy, and also can be distinguished easily from sour milk by its appearance. Rennety milk usually curdles with separation of clean whey and a compact curd, whereas sour milk curdles uniformly throughout. This defect arises spasmodically, and may be attributable to unusual weather conditions, and to the lack of efficient cooling of the milk. The well-known phenomena of milk being specially liable to curdle in thundery weather does not seem to be ascribable to any other reason than the high temperatures which usually precede a thunderstorm.

This was one of those peculiar cases in which the temperature had not been low enough for the development of favourable bacteria, but where higher temperatures had favoured the growth of undesirable types. If the temperatures had been low enough, the development of desirable microbes would have largely prevented the growth of the undesirable. Thence the importance of keeping the temperatures as low as possible, and the need for rapid cooling of milk. The quicker the animal heat is removed from the milk the less possibility there is of unfavourable changes taking place, due to microbes. As the warmer weather approaches, the need for cooling becomes more and more apparent. Therefore, it is necessary to see that the quality of the milk and cream is not graded down due to lack of a cooling system or to badly-cooled milk. Energy expended in endeavouring to cool milk supplies will be amply repaid by the choice quality cream produced.—L. E. NICHOLS, Dairy Research Laboratory.

Orchard Notes

APRIL.

THE COASTAL DISTRICTS.

IN the Orchard Notes for March the attention of citrus growers was called to the necessity of their taking the greatest possible care in the gathering, handling, sweating, grading, and packing of the coming crop of fruit, as the returns for the labour expended in the upkeep of their orchards will depend entirely on the condition in which the fruit reaches the market. Many growers fail to realise the very important fact that the success of fruitgrowing does not depend merely on the proper working and management of the orchard, so essential for the production of a good crop of high-class fruit, but that the manner in which the fruit is handled and placed on the market is of even greater importance. In no branch of fruit culture is this more evident than in the case of citrus fruits, as no fruit pays better for the extra care and attention necessary to enable it to be marketed in the best possible condition. Every season there is more or less loss in the consignments sent to the Southern markets, the percentage depending mainly on the weather conditions, the loss in a wet year being much heavier than that in a dry year.

A very large percentage of the loss is due to what is known as blue mould—a rotting of the fruit caused by a mould fungus—and this loss can be prevented, provided necessary precautions are taken. Although this matter was dealt with last month, it is of such vital importance to our citrus-growers that it is necessary to again refer to it.

In the first place, growers must clearly understand that blue mould cannot occur on perfect fruit, the skin of which is free from injury of any kind. The fungus causing blue mould can only obtain an entry into the fruit through an injury to the skin; it will thus be seen that the remedy is to take every possible care not to injure the skin of the fruit in any way.

Few growers realise how easily the skin of citrus fruits is injured, especially that of fruit grown under moist and humid conditions, when the skin is full of moisture and so tender that the least sign of rough handling causes serious injury. The cells of the skin are so brittle that they are easily broken, and when so broken a ready means of entry for the mould fungus is provided, and blue mould follows in due course.

The remedy for blue mould is in the hands of the grower, who must learn so to gather, handle, and transport the fruit from the orchard to the packing-shed that it does not receive the slightest injury, and further, that when it has reached the packing-shed it must be carefully placed in shallow bins or on trays and be exposed to the air for at least seven days, so that the surplus moisture in the skin may be removed, and the skin thus become toughened and less easily injured. This drying of the skin is known as "sweating," and during the time the fruit is being sweated it should be kept under observation, and all fruit showing signs of blue mould or injury from fruit flies, sucking or boring insects, mechanical injury or bruising, should be removed.

In order to prevent injuring the skin when gathering, all fruit must be cut and not pulled. Gloves should be used to handle the fruit, and when cut it should be placed in padded baskets or other suitable receptacles. Any fruit that falls or is injured in any way should be rejected, as it is not fit to send to a distant market. At the same time, if the injury is only slight, it can be sent to a local market for quick sale.

For oversea and interstate markets only perfect fruit should be selected, and further, it must be graded for size, colour, and quality, and properly packed, only one grade of fruit being packed in a case. The cost of cases, freight, and marketing is now so high that only the best fruit will pay to export, and even the best fruit must be properly graded and packed in order to produce the best returns.

All orchards, vineyards, and plantations not thoroughly clean should receive immediate attention, for from now until the next rainy season the ground must be kept in a thorough state of tilth and free from weeds in order, firstly, to retain moisture in the soil, and, secondly, to enable birds, ants, and predacious insects to get at and destroy the pupæ of fruit flies and other pests harbouring in the soil.

Banana and pineapple plantations must be put into good order, and kept free from weed growth.

Land to be planted with trees should be got ready, as, if possible, it is always advisable to allow newly-cleared land time to sweeten before planting.

Farm Notes

APRIL.

FIELD.—Those areas already lying in fallow for subsequent sowing with wheat should be kept in good tilth, using field implements that have a stirring effect in preference to those which tend to reverse the surface soil. The surface should never be allowed to cake; consequently all showers must be followed by cultivation, as soon as conditions will permit of teams and implements working freely.

Early fodder crops, such as barley (skinless or Cape) and certain varieties of wheat may be sown during April. Growers of winter fodders will be well advised to study the article dealing with dairy fodder plots which appeared in February, 1922, Journal.

Potatoes should now be showing good growth, and must be kept free from all weed growths by means of the scuffler. If sufficiently advanced, and any doubt exists as to the prevalence of blight, advantage should be taken of fine weather to give a second spraying of Bordeaux mixture, a calm and somewhat cloudy day being chosen if possible for the spraying.

Where land has been previously well prepared, lucerne sowing should be carried out this month, and intending growers of this fodder will be well advised to ascertain the germinating qualities of seed submitted to them for purchase. The difference between a good and bad "strike" is often traceable to the poor class of seed sown.

Maize and cotton crops should now be in the harvesting stage, and, once matured, are better in the barn than the open paddock, where weevils and other insects are usually prevalent at this season of the year.

Root crops sown last month should now be making fair growth, and during the early period of such should be kept free from weeds, and where necessary thinned out. Sowings of mangels, swedes, field carrots, sugar-beet, and rape may still be made where conditions of moisture will permit.

As the sowing season is close at hand for certain varieties of wheat—i.e., those which require a fairly long period to develop in—every effort should be made to bring the seed-bed into the best possible tilth and to free it from foreign growths of all kinds. The grading of all seed-wheat is strongly recommended, and growers who favour certain varieties should adopt a system of seed selection from prolific strains with a view to the raising of larger quantities of pure typical grain for ultimately sowing in their larger fields.

Pickling of wheat to prevent smut (bunt) is necessary. Germination tests should be carried out prior to commencing seeding operations.

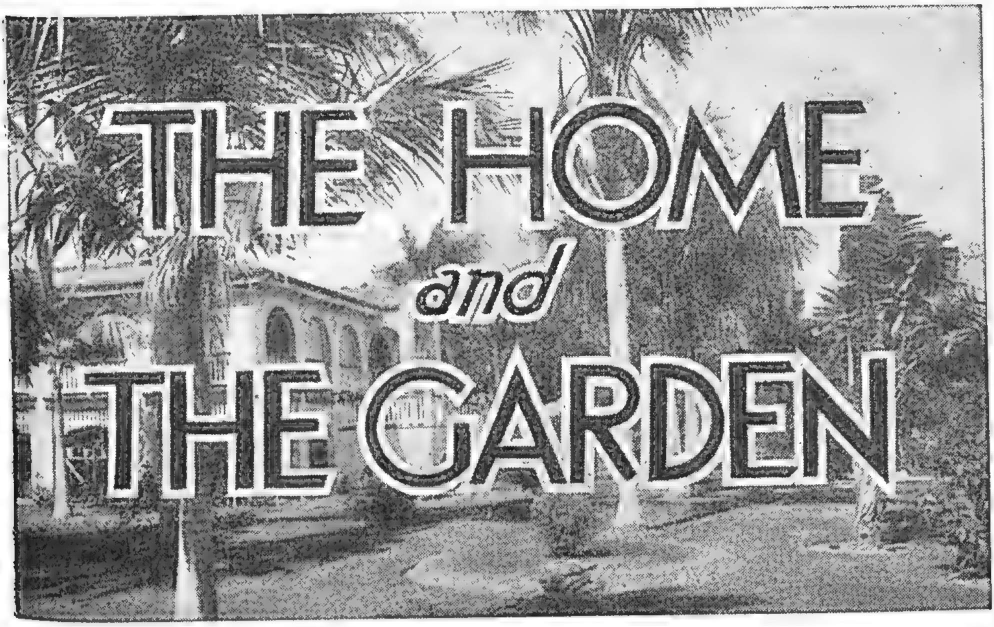
Sorghums which have matured and are not immediately required as green fodder should, wherever possible, be conserved as ensilage to provide for a reserve, to tide over the period when grasses and herbage are dry. Succulent fodder of this description is the best possible form of insurance against drought, and for maintaining dairy and other stock in thrifty condition.

SCOURS IN YOUNG PIGS.

Scouring due to nutritional anæmia often causes serious losses among suckers. The symptoms first noticed are marked paleness of the skin and failure to put on weight. Scouring generally develops three weeks from birth.

The trouble can readily be treated as follows:—

Dissolve ¾ oz. copper sulphate crystals and 4 oz. ferric sulphate in 1 pint of warm water. Stir in a pint of treacle. Smear the sow's udder lightly with the preparation twice daily. If the mixture irritates the sow—through small lesions in the udder—it may be painted in a strip along the bottom rail of the pen. If the timber is splintery, open an old motor tyre and nail it firmly to the rail. Paint the tyre. The young pigs readily acquire a taste for the material. Continue the treatment until weaning.



OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

BREAD—OLD AND NEW.

HOW many thousand years the grain of the wheat has been used by mankind for food we do not know. From the earliest times, the hard grain was ground by hand between two stones in small quantities as it was needed. Gradually this laborious hand grinding was replaced by simple machinery employing stone rollers worked at first by slave or animal labour, later by wind or water power, and quite recently by steam. From all these methods the product was the same; the whole grain was torn to pieces to make wholemeal flour. All wheaten bread was made from this wholemeal flour, and it was a first-class food.

White Bread.

Compared with wholemeal bread, white bread is a thing of yesterday. It dates from only seventy years back, when steel rollers were first introduced in the flour mills in America. These steel rollers produced a very fine white flour, from which the wheat embryo and the bran were sifted out. White flour can be kept for much longer than wholemeal flour, and this is a great convenience for commerce. Unfortunately, the valuable vitamins in the wheat grain are all in the parts of the grain sifted out. As their existence was unknown, no one knew of their absence.

The bread which has formed such a large part of our food was seriously altered in quality; it was still a nourishing food, but it was no longer a health-giving food. Those who lived largely on bread, either

from necessity or choice, suffered from a partial want of vitamins. One consequence of this was the growth of an enormous trade in aperients of all sorts—a trade which is still flourishing.

Wholemeal Bread.

Lately there has been a revival in the use of wholemeal bread. There is, fortunately, still one stone-roller mill in Queensland, and this suffices to supply many bakers. This revival has been the result of many years' work by medical men and health reformers. Yet it does not seem to be realised that wholemeal bread is no new thing, but the good bread on which men have lived for scores of centuries; and the white bread, to which we have become so accustomed, is really a comparatively new thing, which after a short seventy years has been completely discredited as a basic diet.

The Newest Bread.

There are some people who do not like wholemeal bread, though there are only a very few with whom it does not agree. For them there is an alternative in a new sort of bread, which is very palatable. This bread is made of white flour with the addition of a fixed proportion of separately ground wheat embryo. It contains the valuable vitamins of the wheat grain in even larger proportion than does wholemeal bread, and this is an advantage, for in many kinds of foods besides bread there is a deficiency in these vitamins. Cerevite bread, as it is called, is being largely consumed locally.

Most trades are intensely conservative, and it is only natural that many millers and bakers are opposed to wholemeal and cerevite breads. This matters little, for the trade will supply what their customers want, and the enterprising tradesmen will reap the profit.

IN THE FARM KITCHEN.

Eggs San Remo.

Take 6oz. shortcrust, 6 eggs, 1½ gills cheese sauce, paprika to taste.

Roll pastry out to quarter of an inch thickness on a floured pastry-board. Cut into rounds and line some tartlet tins with them. Prick the bottoms with a fork, and bake till crisp and pale golden in colour. Drop a lightly-poached or steamed egg into each. Cover each with a tablespoonful of cheese sauce. Dredge lightly with paprika. Serve with a green salad. Make the cheese sauce by heating a beaten egg-yolk in a double boiler, and by adding it gradually to a cupful of white sauce. Heat for one minute, then add 1 tablespoonful grated cheese, a nut of butter, and seasoning.

Eggs Lyonnaise.

Take 6 eggs, 2 onions, 1½ gills stock, 1 teaspoonful flour, 1oz. butter, pepper and salt to taste, 6 croutes fried bread.

Boil eggs till hard. Peel and mince the onions. Melt butter in a saucepan. Add flour and fry till brown, add onions and brown slightly. Add stock. Season to taste with salt and pepper, then simmer until creamy. Remove shells from eggs, then remove carefully the yolks from the whites. Mince egg-white and add to onion sauce. Bring to the boil. Heap croutes of bread with the sauce, place a yolk on top of each croute, and dab each yolk with a little of the sauce.

Water Lily Salad.

Take 6 hard-boiled eggs, 6 stuffed olives, 1 large lettuce, 1 teaspoonful chopped parsley, radishes, vinegar, olive oil, seasoning.

Boil the eggs for thirty minutes, chill in cold water, shell and cut lengthways, from small end nearly to the other, until six petals are formed. Take out yolks and beat them till smooth, with vinegar, oil, and seasoning to taste, and form into cone-shaped balls. Lay the white petals in the centre of a bed of heart of lettuce leaves, arranged on individual salad plates. Place a cone in centre of each lily, and sprinkle it lightly with finely-chopped parsley. Garnish with one or two tiny radishes and small olives to resemble buds, and mask with a little French dressing.

Spanish Omelette.

Take 3 eggs, 1½ tablespoonfuls cooked peas, 1½ tablespoonfuls tomato, 2 tablespoonfuls water, 1 tablespoonful pimento, ½ tablespoonful butter, pepper, salt, and paprika to taste.

Break the eggs into a basin. Beat slightly and add water. Season. Slice tomato and pimento finely. Stir them with the cooked peas into the beaten eggs. Melt butter in an omelette pan until smoking hot, but not more than slightly brown. Pour in the mixture. Cook quickly till slightly browned beneath and just set on top. Slip on to a hot dish, fold, and serve quickly, garnished with parsley.

Buttered Eggs.

Take 4 hard-boiled eggs, 1 cupful milk, 1 tablespoonful butter, pepper, 6 slices toast, 1½ tablespoonfuls flour, ½ teaspoonful salt, parsley.

Make a thin white sauce with the butter, flour, milk, and the seasonings. Remove the yolks from hard-boiled eggs. Chop the whites finely and add to the sauce. Butter the toast and cover four slices with sauce. Force two of the egg-yolks through a strainer on to the sauce. Garnish with remainder of toast cut into points, and the parsley.

Egg and Mushroom Pie.

Take ½lb. fresh mushrooms, 4 eggs, 2 tablespoonfuls butter, 2 tablespoonfuls breadcrumbs, salt, pepper, and paprika to taste.

Parboil the peeled and washed mushrooms, then saute in a saucepan with the butter and seasonings to taste for ten minutes. Pour into a shallow (au gratin) dish. Gently slip one egg after another on top. Season to taste. Sprinkle with fine breadcrumbs, dab with tiny pieces of butter, and bake until the eggs are just set.

Stuffed Eggs and Jellied Peas.

Take 3 eggs, 1½oz. butter, seasoning, 1 cupful cooked peas, aspic jelly, 1 lettuce, mayonnaise to moisten.

Boil eggs until hard. When cold, shell, cut in half, and remove yolks carefully. Mash these with the butter. Season to taste and moisten with the mayonnaise. Pile up in the egg-whites. If wanted more decorative, sieve the mixture and force mixture into the shells with a forcing pipe. Drain the peas. Divide between five small moulds and fill them up with aspic jelly. Leave till set. Turn out carefully. Serve eggs and moulds on a dish with lettuce leaves.

Aspic Jelly.

Take ½oz. gelatine, ¾ pint white stock, 1 small onion, 3 tablespoonfuls vinegar, bay-leaf, parsley, piece carrot, salt.

Moisten gelatine in a little of the stock and let stand for half an hour. Put the remainder of stock in a saucepan with other ingredients, and bring to the boil. Pour on the gelatine and stir till dissolved. Leave to cool. Strain through a very fine strainer. Before using, add a little browning to colour. Use as required.

Eggs and Anchovies.

Take 6 eggs, 1 teaspoonful minced eschalot, 2oz. butter, anchovies, toast, salt and pepper, 1 tablespoonful milk.

Beat up the eggs with pepper and salt to taste and the minced eschalot. Put the butter into a saucepan with the milk. As soon as the butter is melted, pour in the eggs and stir until it thickens. Prepare some hot buttered toast, spread the mixture over the toast, and put a fillet of anchovy on each piece.

Savoury Egg Toast.

Take 2 eggs, salt and pepper, 2 tablespoonfuls milk, 1oz. butter, anchovy paste, buttered toast.

Prepare the buttered toast in the usual way, and spread it thickly with anchovy paste, and keep it warm. Beat the eggs and mix them with the milk, adding seasoning to taste. Melt the butter in a saucepan, add the eggs, and stir these till they thicken and begin to set. Turn the egg mixture on to prepared toast, and serve.

Egg and Tomato.

Take 2 eggs, 1 gill tomato ketchup, ½oz. butter, ½ gill gravy, salt and pepper.

Place a spoonful of sauce and gravy and a small piece of butter in two ramekin cases. Put an egg in each and cover with tomato sauce and the remainder of the butter. Bake for seven or eight minutes or until set in a fairly hot oven.

Maltese Eggs.

Take a tablespoonful minced ham, 2oz. butter, 1oz. grated Parmesan cheese, 1 lemon, ½ pint white stock, 1 large tomato, pepper, salt, parsley, 6 eggs.

Mix together in a saucepan the ham, butter, cheese, lemon juice, salt, pepper, and parsley to taste, the stock, and one large tomato, sliced. Let this stew for twenty minutes, then strain it over a dish containing six hard-boiled eggs. Cover with breadcrumbs and some grated cheese. Bake in a very hot oven for just sufficient time to brown the surface, and serve in the same dish.

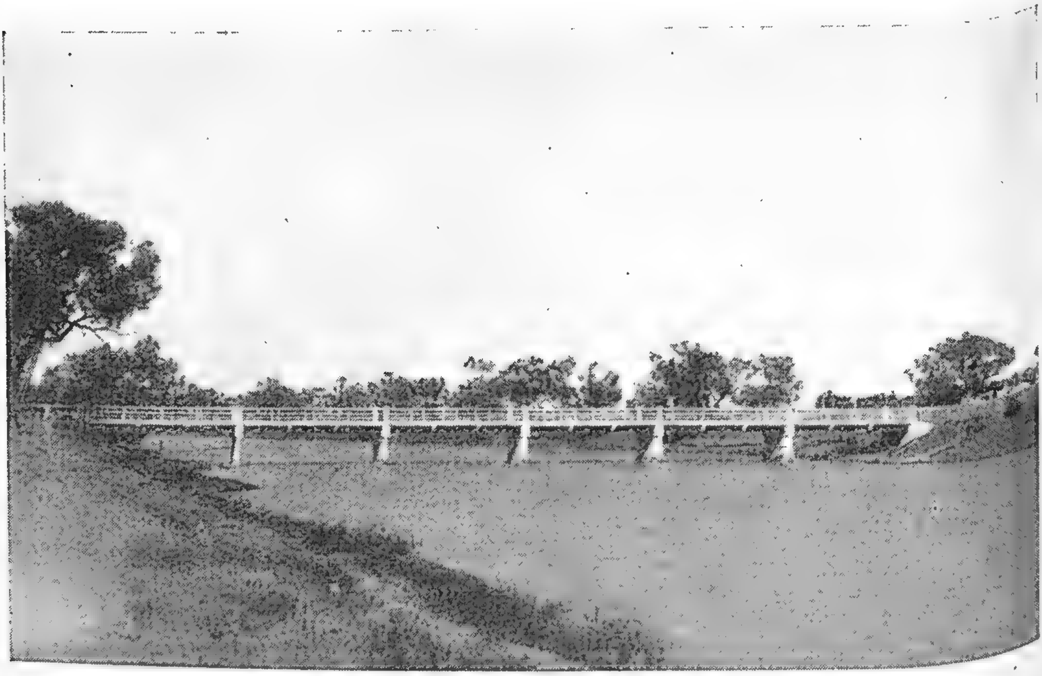


PLATE 125.

NEW BRIDGE OVER THE THOMPSON AT LONGREACH.—This steel and concrete structure has replaced the old wooden bridge, well known to old Westerners, on the Longreach-Winton Road.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JANUARY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1936 AND 1935, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Jan.	No. of Years' Records.	Jan., 1937.	Jan., 1936.
	In.		In.	In.
North Coast.				
Atherton	11·99	36	5·87	8·35
Cairns	61·70	55	8·92	16·76
Cardwell	16 92	65	14·49	10·69
Cooktown	14·44	61	12·66	10·01
Herberton	9·67	51	4·32	7·20
Ingham	15·66	45	11·18	10·65
Innisfail	20·26	56	7·72	10·53
Mossman Mill ..	17·94	24	12·47	12·11
Townsville	10·98	66	5·52	7·66
Central Coast.				
Ayr	10·98	50	7·78	10·75
Bowen	10·00	66	1·57	8·15
Charters Towers ..	5·41	55	5·35	2·39
Mackay	14·10	66	2·81	8·78
Proserpine	15·83	34	5·06	18·81
St. Lawrence ..	9·29	66	5·20	10·14
South Coast.				
Biggenden	5·20	38	0·85	4·92
Bundaberg	8·64	54	3·61	4·77
Brisbane	6·44	85	1·57	5·73
Caboolture	7·57	50	2·10	5·12
Childers	7·38	42	2·73	4·48
Crohamhurst.. ..	12·26	44	2·11	6·01
Esk	5·74	50	1·17	6·44
Gayndah	4·61	66	1·89	5·78
Gympie	6·62	67	1·29	6·74
Kilkivan	5·54	58	0·62	6·14
Maryborough ..	7·10	66	1·45	2·86
Nambour	9·62	41	2·54	7·03
Nanango	46·3	55	1·43	3·05
Rockhampton ..	7·66	66	3·85	5·98
Woodford	7·77	50	1·33	5·76

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Jan.,	No. of Years' Records.	Jan., 1937.	Jan., 1936.
	In.		In.	In.
Central Highlands.				
Clermont	5·11	66	4·25	4·88
Gindie	3·71	38	..	4·78
Springsure	4·23	68	1·09	5·43
Darling Downs.				
Dalby	3·31	67	2·94	3·25
Emu Vale	3·22	41	2·01	4·47
Hermitage	3·23	31	0·91	3·57
Jimbour	3·48	49	2·33	2·29
Miles	3·63	52	3·56	1·61
Stanthorpe	3·58	64	7·58	2·88
Toowoomba ..	5·04	65	2·06	4·24
Warwick	3·56	72	2·57	4·44
Maranoa.				
Roma	3·08	63	1·86	2·18
State Farms, &c.				
Bungeworgoral ..	1·82	22	..	1·95
Gatton College ..	4·34	38	5·97	6·21
Kairi	9·87	21	..	3·82
Mackay Sugar Experiment Station	13·99	40	5·11	11 62

A. S. RICHARDS, Divisional Meteorologist.

THE IMPORTANCE OF THE SEPARATOR FLOAT.

Probably the most neglected part of the separator is the float, the function of which is to regulate the flow of milk into the bowl.

This means that it should be perfectly balanced, otherwise an irregular flow occurs and inefficient separation and fluctuation of tests result.

It has been frequently found that floats are badly dented, or leaking. To this condition is added the danger of throwing the float out of balance by amateur repairs. It has also been found that leaking floats have been repaired without first emptying them, which makes them heavier than designed.

Probably the most serious aspect of damaged floats is the fact that cracks and badly soldered joints provide ideal conditions for the growth of bacteria and in consequence milk passing over them becomes contaminated, resulting in many cases of cream being graded down.

Dairymen would be well advised to give consideration to this matter and when repairs are necessary to have them carried out by a competent tradesman, who should be advised of the importance of the work.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

MOONRISE.

	March, 1937.		April. 1937.		Mar., 1937.	April. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·46	6·24	6·2	5·50	8·23	9·2
2	5·46	6·23	6·3	5·49	8·59	9·52
3	5·47	6·23	6·3	5·48	9·38	10·44
4	5·47	6·22	6·4	5·46	10·12	11·41
5	5·48	6·21	6·4	5·45	11·8	..
						a.m.
6	5·48	6·21	6·5	5·44	11·59	12·37
					a.m.	
7	5·49	6·20	6·5	5·43	..	1·35
8	5·49	6·19	6·6	5·42	12·54	2·36
9	5·50	6·18	6·6	5·41	1·53	3·38
10	5·50	6·16	6·7	5·40	2·52	4·40
11	5·51	6·15	6·7	5·39	3·54	5·49
12	5·51	6·14	6·8	5·38	4·55	6·56
13	5·52	6·12	6·8	5·37	5·58	8·6
14	5·52	6·11	6·9	5·36	7·1	9·14
15	5·53	6·10	6·9	5·35	8·8	10·19
16	5·54	6·8	6·10	5·34	9·15	11·17
						p.m.
17	5·54	6·7	6·10	5·34	10·22	12·10
18	5·55	6·6	6 11	5·33	11·27	12·53
					p.m.	
19	5·55	6·5	6·11	5·32	12·28	1·33
20	5·56	6·4	6·12	5·31	1·23	2·9
21	5·56	6·3	6·12	5·30	2·11	2·43
22	5·57	6·2	6·13	5·29	2·54	3·16
23	5·57	6·1	6·13	5·28	3·33	3·50
24	5·58	6·0	6·14	5·26	4·8	4·21
25	5·59	5·59	6·14	5·25	4·41	4·54
26	5·59	5·57	6·15	5·24	5·16	5·34
27	6·0	5·56	6·15	5·24	5·49	6·14
28	6·0	5·54	6·16	5·23	6·22	6.59
29	6·1	5·53	6·16	5·22	6·59	7·46
30	6·1	5·51	6·17	5·21	7·36	8·38
31	6·2	5·50			8·17	

5 Mar.	☽ Last Quarter	7 17 p.m.
13 ,,	● New Moon	5 32 a.m.
19 ,,	☾ First Quarter	9 46 p.m.
27 ,,	○ Full Moon	9 12 a.m.

Apogee, 3rd March, at 6.0 p.m.
Perigee, 15th March, at 1.0 p.m.

Saturn, so inconspicuous to the naked eye, but the most wonderful of planets in the telescope, will on the 16th go down with the Sun and disappear from the evening sky. The rings which are now seen edgewise from the Earth will not be fully open until 1943.

On the 21st, at 11 a.m., the Sun will cross the celestial equator from south to north, and the Australian Autumnal Equinox will occur, the day and night being almost equal. The Sun will then rise due east and set due west, and it will be found useful to mark these points with reference to the horizon.

On the 25th Mercury will be in superior conjunction with the Sun—beyond the Sun from an observer on the Earth. It will on that day set with the Sun, after which it will night after night remain a little longer above the horizon after sunset, until it again reaches its greatest eastern elongation.

On the 27th Venus will apparently come to a standstill, and for about a month seem to move with retrograde motion.

Mercury rises at 4.18 a.m., 1 hr. 28 min. before the Sun, and sets at 5.32 p.m., 52 min. before it, on the 1st; on the 15th it will rise at 5.9 a.m., 44 min. before the Sun, and set at 5.50 p.m., 20 min. before it.

Venus rises at 9.15 a.m., 3 hr. 24 min. after the Sun, and sets at 8.16 p.m., 1 hr. 52 min. after it, on the 1st; on the 15th it rises at 8.54 a.m., 3 hr. 1 min. after the Sun, and sets at 7.41 p.m., 1 hr. 31 min. after it.

Mars rises at 10.13 p.m., and sets at 11.35 a.m. on the 1st; on the 15th it rises at 9.34 p.m., and sets at 11.3 a.m.

Jupiter rises at 1.54 a.m., and sets at 3.32 p.m. on the 1st; on the 15th it rises at 1.8 a.m., and sets at 2.49 p.m.

Saturn rises at 6.45 a.m., and sets at 7.11 p.m. on the 1st; on the 15th it rises at 5.44 a.m. and sets at 6.5 p.m.

The Southern Cross will come into view early in the evening in March. It will be at position III., as on the clock face, about 8 o'clock, and erect about 2 o'clock in the morning on the 1st March, an hour earlier in the middle of the month and two hours earlier at the end.

Phases of the Moon, Occultations, &c.

4 Apr.	☽ Last Quarter	1 53 p.m.
11 ,,	● New Moon	3 10 p.m.
18 ,,	☾ First Quarter	6 34 a.m.
26 ,,	○ Full Moon	1 23 a.m.

Perigee, 12th April, at 6 p.m.
Apogee, 27th April, at 8 p.m.

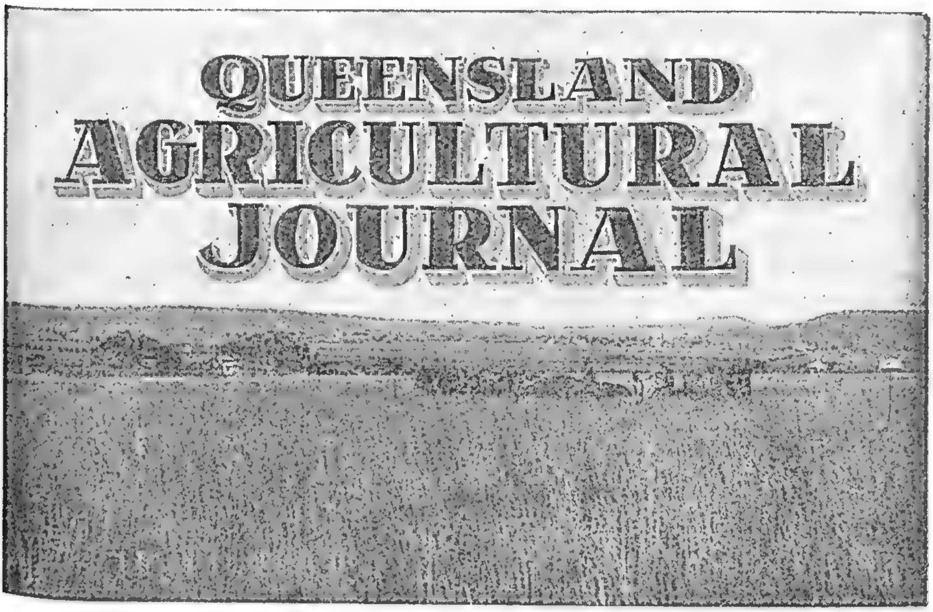
For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, One Shilling, members of Agricultural Societies, Five Shillings, including postage. General Public, Ten shillings, including postage.



VOL. XLVII. 1 APRIL, 1937. PART 4

Event and Comment

Farming in the Far North.

IMPORTANT field problems were studied closely by the Minister for Agriculture and Stock (Mr. Frank W. Bulcock) during a recent visit to North Queensland, an official tour which extended as far as the new dairy lands on the Daintree River. Soil erosion, grassland improvement, the incidence of the white grub pest in paspalum pastures, and the possibility of extending the fat lamb scheme were among the major subjects of investigation. On his return, Mr. Bulcock remarked that some of the agricultural and pastoral problems of the Atherton Tableland were intricate and perplexing and he proposed to make a special effort to devise means of solving them. The work of pasture renovation would involve much research work, he said, and he proposed a plan of co-ordination in which the district agricultural staff and the Bureau of Tropical Agriculture at South Johnstone would assist. In the course of his tour among the farms Mr. Bulcock saw some crossbred lambs slaughtered. Two crosses were represented in the yarding—Dorset Horn-Merino and Romney Marsh-Merino. The Romney cross was of fair to average quality, while the Dorset cross produced lambs of superfine quality. The progress of the scheme for fattening inland-bred beef cattle on the coastal country also claimed the Minister's attention. The

success of this scheme and that of lamb raising on the high tableland country would obviously become an important factor in the future development of the rich territory of the North.

The Case for Australia at the Sugar Conference.

ALTHOUGH the statistical position of world sugar is improving steadily, the surplus production problem continues as one of our major marketing anxieties. Present hopes are centred on increased world consumption, and the trend is certainly in that direction. Under recent legislation, agriculture in Britain is now assured apparently of a beet sugar industry that will, up to an agreed limit of output, continue to provide a profitable rotational crop, and that there will be no reversion to a state of dependence wholly by the Old Country on sugar imports. The Queensland cane farmer was, no doubt, relieved to learn last year that the limits fixed under the new law would not affect immediately the volume of their sugar exports to the British market. In fact, at the time it was claimed that the new measure was a material contribution to ordered control of the world sugar output. What will be the outcome of the international sugar conference now sitting in London is, however, within the realms of uncertainty. Cabled opinions have passed through the whole gamut of expression from gloomy pessimism to super-optimism.

So far as Australia is concerned, the existing preferential tariff on Empire sugar means to us about £2,500,000 a year—the annual value of our sugar shipments to Britain. The effects of its withdrawal—a distinct possibility—would be felt immediately. Reduced output and the consequent throwing of large numbers of people on to an already over-supplied labour market would be inevitable.

More than twenty countries are represented at the international conference now in session. The gathering is one of the most important in the history of the world sugar industry, and Australia is, therefore, very fortunate in its strong representation, which includes the Premier of Queensland, Mr. Forgan Smith.

Presenting the case for Australia, the Commonwealth Treasurer (Mr. R. G. Casey) emphasised that the world price of sugar had for an extended period remained uneconomic and disastrously low. Despite small preferences from the United Kingdom and Canada, the loss on Australian exports was particularly heavy, because Australia was the only country in the whole world producing cane sugar entirely by white labour, necessitating high wage-rates. Other countries in this matter had a tremendous advantage over Australia, which therefore would endeavour to support any fair and equitable plan to raise world prices to a reasonable level.

Continuing his exposition, Mr. Casey pointed out that directly and indirectly the sugar industry was responsible for 75 per cent. of Australia's present activities in the tropics. Therefore its maintenance and welfare were important. However, Australia's contribution to world stabilisation would require to be governed by the paramount necessity of avoiding any drastic curtailment in production by reduced exports. The Australian sugar industry had been gradually developed over seventy years in *bona fide* circumstances and in the face of many difficulties, and any drastic limitation in output would create graver problems in the parts of Australia concerned than in other countries enjoying a greater diversity of agriculture and more flexible social conditions and standards of living.

Mr. Casey urged the necessity of increasing consumption in the low consumption countries, which, if attained to even a limited extent, would solve the problem of over-production and produce a shortage in supplies. He pointed out that while New Zealand consumed 119 lb. per head, Australia 112·21 lb., and Britain 107·58 lb., Germany consumed only 52·23 lb., Czechoslovakia 55·10 lb., Hungary 23·80 lb., Poland 22.26 lb., Belgium 62·15 lb.

"Moreover, an arbitrary reduction in exports of sugar or of any other Australian commodity," continued Mr. Casey, "is a matter for serious consideration by a country with large external financial obligations, unless a higher price is received for the reduced exports and there is a possibility of alternative compensatory employment. It is essential that the conference should devise a plan to prevent any international agreement being thwarted by non-signatory Powers."

The British View.

MR. RAMSAY MACDONALD, in his inaugural speech, drew attention to the improvement in the statistical position, but pointed out that the world price was only remunerative to the cheapest producers. The fundamental object of the conference should be to assure stability. The United Kingdom, which was a large consumer, did not favour an increase in prices above a just economic level.

Mr. MacDonald suggested that countries not exporting on a free market should regulate production to maintain the free market at as high a figure as possible. Countries supplying a free market should regulate exports to keep supplies at a level appropriate to the possible demand. All countries should do what they could, if free market prices rose to an economic level, to adjust protective duties and subsidies to prevent internal prices from rising to a point that would check consumption and stimulating new production. A general agreement like that for tin and rubber was impossible. The conference must draw up rules applicable to each group of countries. The allocation of export quotas was not easy. He hoped that exporting countries would not seek quotas based on theoretical considerations, but would keep strictly within the limitations of the free market. Others might be asked to keep their internal production at an agreed maximum.

Mr. MacDonald suggested the appointment of a statistical committee and a small bureau to formulate proposals as the discussions proceeded.

The World Sugar Situation.

SUGAR circles are not without hope of a favourable outcome of the conference, to which the improved statistical position should contribute. World production for the year ending 31st August next is estimated at 30,770,000 tons, and consumption at 30,892,000 tons. It is expected that world stocks, normally 3,500,000 tons, will decline to around 75,000 tons.

The main problem of the conference will be the allocation of tonnage. A considerable difference of opinion exists in regard to the advisability of a restriction scheme based on output quotas. Some consider this would force up production costs to the disadvantage of British colonial producers, and would prefer a restriction of acreage with a view to fostering the most efficient producers.

The Grasshopper Outbreak in Queensland.

1934-35.

J. A. WEDDELL, Entomologist.

[*Continued from p. 259, Part III., Vol. XLVII.—March, 1937.*]

SECTION II.

LIFE HISTORY AND HABITS OF CHORTOICETES TERMINIFERA WALK. IN SOUTH-EASTERN QUEENSLAND.

Summary of Life-cycle Stages.

The species *C. terminifera* follows the developmental changes normal to members of the family Acridiidæ.

The eggs (Plate 126, figs. 1 and 2, and Plates 127 and 128) are laid in the earth in batches, each egg being approximately 5 millimetres long and 1 millimetre in diameter and light-brown in colour. The eggs normally fill the lower two-thirds of the egg hole. They are embedded in and covered by a frothy secretion from the parent insect, which hardens, giving a somewhat crystalline appearance when examined.

The stage immediately following the hatching of the egg has a very brief existence, and, because of its unusual structure, it is generally referred to as a pre-nymphal stage and termed the vermiform larva, and is not regarded as a true nymph (Plate 126, fif. 3). It is creamy white in colour, about $\frac{1}{4}$ inch in length, and it is quite helpless on emergence above ground. The emergence of this stage and its transformation to the active hopper is later outlined.

There are five nymphal or active hopper stages (Plate 126, figs. 4 and 5). The first is approximately $\frac{1}{4}$ inch in length, the measurements of the subsequent stages being largely determined by the availability of food. The general colour of the first hopper stage is grey to greyish-brown, but the later instars are brown with dark-brown markings; a percentage of individuals, however, develop gradually a general green colouration with brown or grey-brown markings. The wing-buds may be readily distinguished on instars III., IV., and V.

The adults (Plate 126, figs. 6 and 7) are of two main colour types with grading intermediate forms. The brown insects were usually by far the more numerous; a few green variants could, however, be easily distinguished, while in some swarms the green forms were almost in the majority. Swarms seen at Tara and Yarranlea in November, 1934, included a relatively high percentage of green individuals, while at Goondiwindi at the same time the swarms were predominantly brown.

Adults varied greatly in size, measurements from the front of the head to the tip of the folded wing varying from 0.95 inch to 1.65 inch—*i.e.*, from 24 millimetres to 40.5 millimetres.

Egg-beds.

Oviposition was observed in a variety of different situations and soil types during the course of the outbreak. In certain instances heavy laying had occurred in hard-beaten ground completely bare of all vegetation, an outstanding example being earth roads in the Inglewood township. Areas of claypan were also used for egg-beds. These claypans

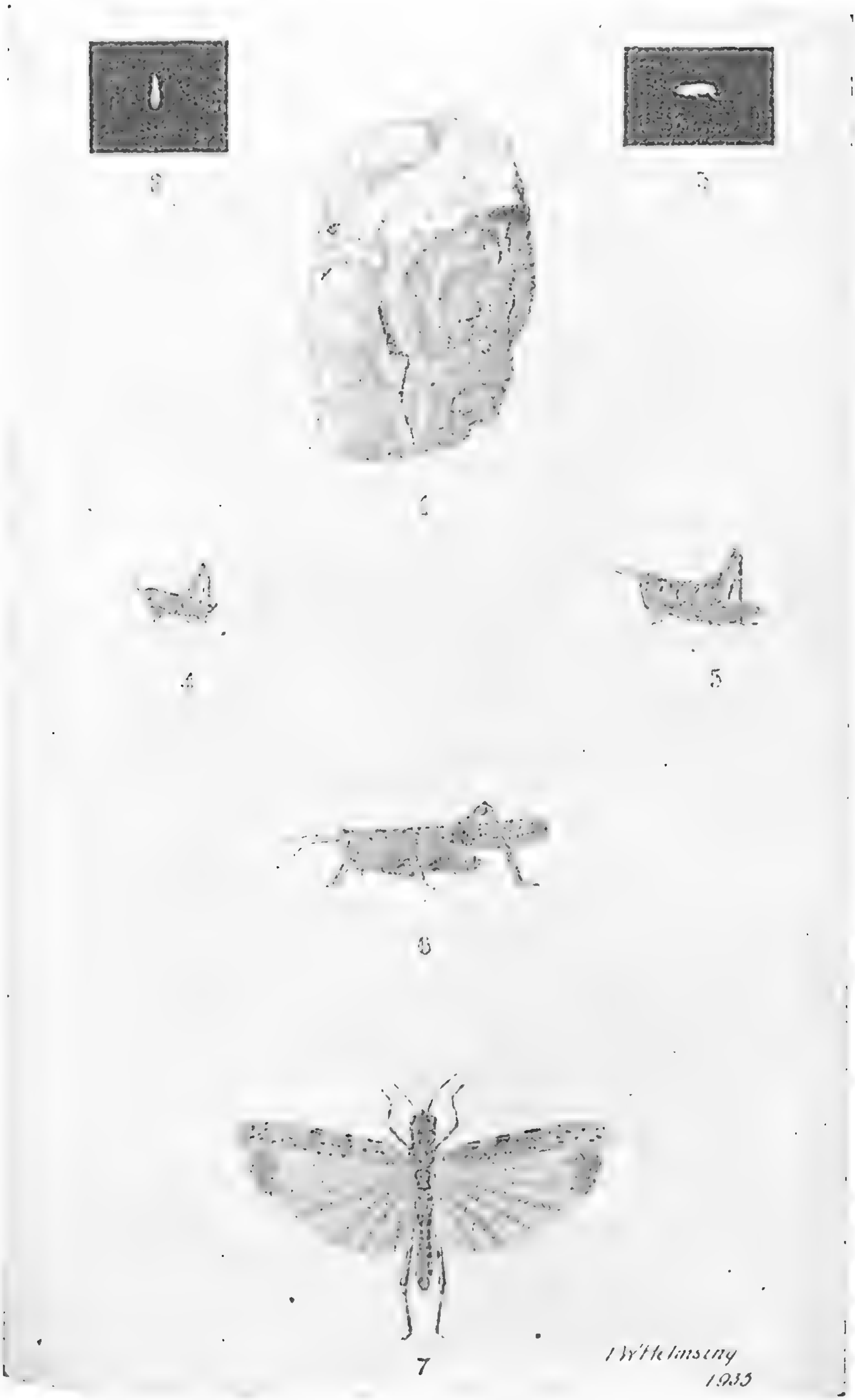


Plate 126.

Fig. 1.—Fragment of soil showing "egg pods" and eggs *in situ*. Fig. 2.—Egg. Fig. 3.—Newly emerged hopper. Fig. 4.—Later stage hopper. Fig. 5.—Pre-adult hopper. Fig. 6.—Adult male (lateral view). Fig. 7.—Adult male (dorsal view). All figures natural size.

Plate 127.

The under side of a slab of earth removed from egg-bed; note the broken egg pods with eggs *in situ*.

were usually very hard and compact. The more usual sites, however, were those consisting of slightly rising ground, sparsely grassed, showing small areas of bare ground between the tufts of grass and herbage. Hard sandy ridges were also favoured.

A definite hardness of the ground was not by any means a necessary quality of an egg-bed. A surface crust such as that produced by the slight compacting that follows rain was amply sufficient to provide the necessary foothold for the gravid female. Heavy laying was observed in partially cultivated paddocks, between rows of maize, in the sandy loam of a tobacco farm, the ground being almost ready for planting, and in a sandy area carrying a very sparse grass cover. In all cases a slight crust had formed on the surface prior to egg-laying. An example of oviposition on a sandy loam is illustrated by Plate 129, which also shows the effect of heavy rain on the egg-bed. The rain washed the

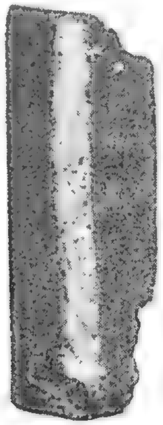


Plate 128.
Vertical section of soil showing egg pod, natural size.

surface soil away and disclosed the egg holes. During oviposition egg-beds could be readily located owing to the swarming females. Further, a percentage of the insects usually became jammed in the soil, and their dead bodies then marked the site for a few days.

As a general rule, however, the actual egg holes were rather difficult to locate prior to hopper emergence, even though egg-laying had been observed. However, when the insects emerge, the small circular earthen cap is pushed from the hole and numbers of the tiny caps may readily be found.

Egg-beds of various dimensions were seen. Those in the Kooroongarra area were usually smaller—rarely exceeding an acre in extent—than those in the Goondiwindi and Inglewood districts, where egg-beds of several acres were not uncommon. Egg holes varied in density up to about 120 per square foot, while eggs in the egg pods ranged from 18 up to 57, the latter being found in an egg-bed in sandy soil. The general average ranged from 30 to 40 eggs per egg pod.

Exceptional behaviour on the part of the gravid female was observed in an egg-bed at Goondiwindi, where a large number of females laid their eggs on fence posts and rails and on the trunks and limbs of trees to a height of 15 feet from the ground. The eggs were all overlaid

by a mass of froth, as though they had been normally deposited. Needless to say, the eggs so laid quickly dried out and no hoppers emerged. (Plate 130.)

Emergence of Hoppers.

The emergence of the hoppers from an egg-bed is very interesting. Apparently the eggs in an egg pod hatch almost simultaneously, and the combined pressure of the young insects serves to dislodge the cap of the hole. The insects then commence to ooze (there is no better word) on to the surface. The first-stage or vermiform larva is white in colour, very weak, helpless, and fragile. It is only about one-quarter of an inch in length, but its slender, soft, white legs are quite incapable of supporting its weight. As a result, the insect lies helplessly on the surface.

Plate 129.
Egg holes disclosed in sandy soil, following heavy washing by rain.

Within periods varying from half an hour to five minutes the pale skin of this first stage splits dorsally and is shed, the moulted skin being finally pushed away from the hind tarsi. Almost simultaneously with the shedding of the skin the insect springs into activity. It stands alert with the jumping legs braced for use. The colouration of the chitin soon becomes evident, and within a few seconds the tiny insect is leaping away.

Habits of the Hoppers.

Hoppers were first observed at Kooroongarra in mid-September, 1934. The days then were just pleasantly warm, with cold nights. Newly hatched swarms were very compact, while further emergences daily increased the insect population. The young hopper swarms remained as compact masses and moved bodily, perhaps only a few feet per day, the movements being, for a period, at least, in no particular direction. The food requirements of these young hoppers appeared to be very slight, but they did feed, particularly on the succulent foliage of trefoils or burr clovers, two species—*Medicago denticulata* Willd. and *M. minima* Lam.—being very common on the Darling Downs. The

somewhat haphazard movements of the swarms usually brought them, in the course of a few days, to slight depressions such as creek banks, melon holes, and so on, where ample supplies of succulent clover were available.

About a fortnight after emergence the hoppers changed their habit and something in the nature of a mass migration commenced. The direction of the migration appeared to be influenced solely by chance. A definite movement in a particular direction began and a heavy massing of individuals on the leading "face" was evident, the main swarm following behind. In the absence of suitable quantities of food,

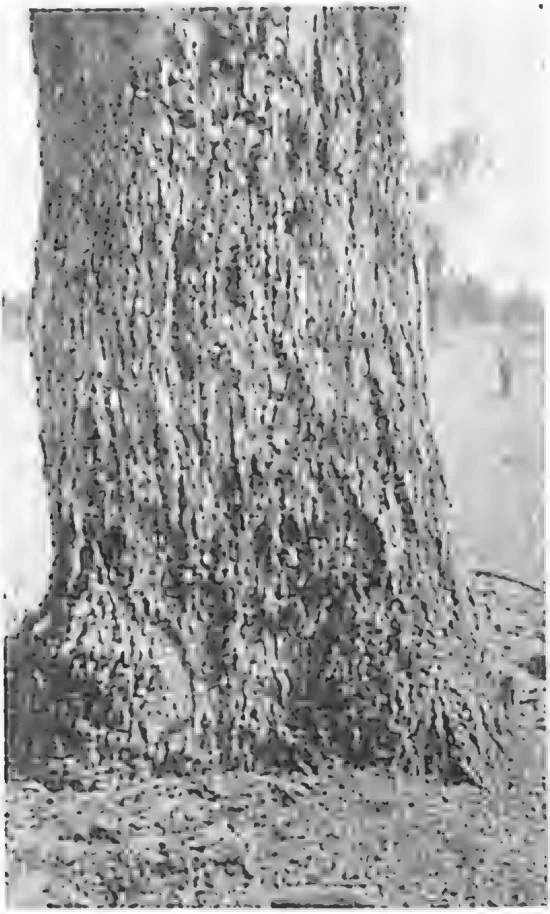


Plate 130.

An extraordinary oviposition site. Note the whitish egg masses on the tree trunk.

the insects moved forward fairly quickly, but when good pasturage was available the rate slackened noticeably and the front line became dense, sometimes over a width of 1 to 3 feet. Forward movement then continued day after day in the direction of the succulent feed. As a result, the appearance of a moving swarm attacking an area of young wheat was quite spectacular, resembling from a distance the daily advance of an irresistible tide.

On clover the young hoppers nibbled the leaves and older hoppers chewed also the young stalks. On tall pasture grasses and grain crops the flag was eaten, but where the grain crop was young and the swarms dense very little of the plant remained when the swarm leaders had passed on.

Plate 131.
Young hoppers clustered as a dark mass on the western side of a log at 5 p.m.

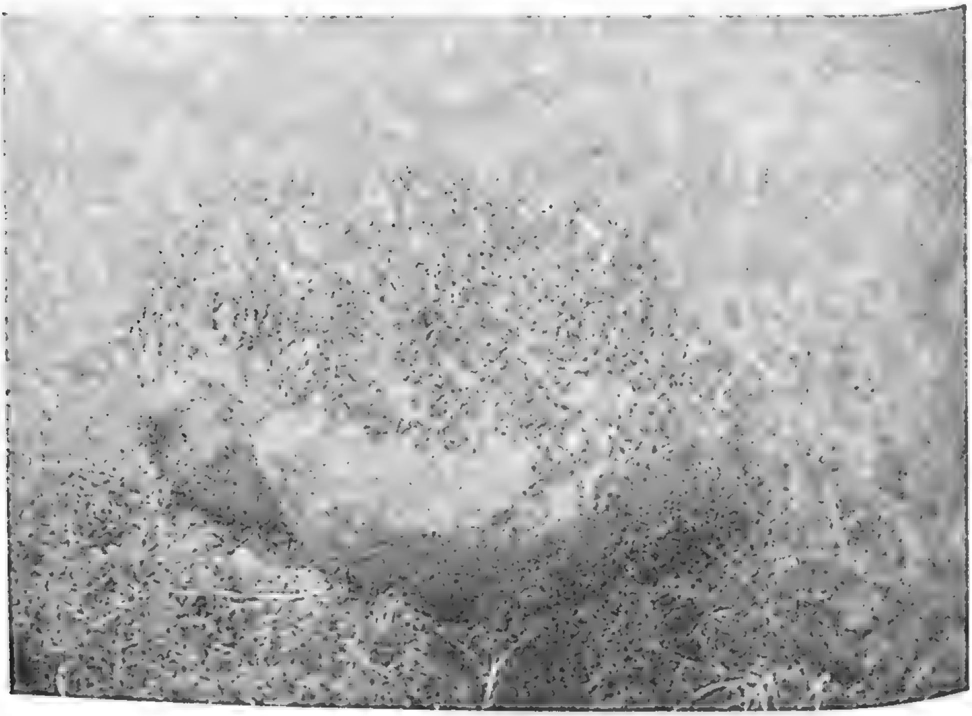


Plate 132.
Young hoppers clustered on a stone.

The reactions of hoppers to various stimuli are comparatively well known, but some points noticed seem worthy of mention. In the morning, up to about 8 a.m., the insects were quite sluggish and had not then abandoned their "sleeping" quarters. With the rising temperature, they became more active and were very easily disturbed. When walking through a swarm, the insects scattered from the line of advance, closing in again behind immediately afterwards. In bright sunlight they were exceedingly sensitive to any sudden movement. Thus, if one stood stationary for a short period, a sudden gesture was sufficient to stimulate the hoppers within a radius of several feet into intense activity, from which they gradually subsided.

As the shadows lengthened in the afternoon there was a general movement up the stalks of weeds, herbage, grass tufts, trunks of trees, logs, fencing, stones—in fact, anything that could be climbed, preferably, it seemed, to a height of about 18 inches above the ground. All such material within the area occupied by a swarm thus assumed a dark-brown to blackish appearance, due to the density of the hoppers (Plates 131 and 132).

The gregarious instinct was very evident, particularly among the young hoppers. The swarms of newly hatched hoppers were relatively small in the Kooroongarra district. The population density was, however, fairly high. One sampling yielded approximately fifteen insects per square inch throughout a swarm measuring approximately 33 yards by 17 yards—a total population of about 10,000,000 individuals. Needless to say, as the insects grew in size and became capable of a wider range of movement, these swarms spread and frequently occupied areas measurable in acres.

An avoidance of shade during the day was a noticeable characteristic of the spring generation (Plate 133). Practically all hopper movement in a swarm ceased during periods of cloud, and the margins of the swarm became noticeably blurred. Immediately the sun reappeared the line became distinct again and the insects moved forward. The next generation, bred under summer conditions, behaved rather differently. The hoppers became quiescent about midday and sought the shade, presumably owing to the higher temperatures.

As the feeding rate is apparently linked with general activity, it is not surprising that, whereas the spring generation fed during the middle of the day, the summer generation spent the midday hours in a state of comparative quiescence. Feeding started earlier in the morning and continued later in the afternoon. This had an important bearing on the selection of times for laying baits as a control measure.

Habits of Adults.

Adults migrated in fairly open or dispersed formation, each wave spreading over a wide area. Some travelled at heights up to 300 feet, but the majority of the population flew only 20 or 30 feet above the ground. Timber usually diverted or stopped the swarms, but sometimes the grasshoppers flew up and over lines of trees. Migration, however, usually took place over open or cleared country. Passing through townships, the adults mainly followed the roads. It was very noticeable that the main migration into the Inglewood district in November, 1934, was from south-west to north-east, following fairly well the improved

properties and the cleared channels represented by the McIntyre Brook, the railway, and the main road, which lay more or less parallel in that direction. Migration along cleared fence lines and firebreaks in timbered country was also observed.

Plate 133.

Portion of swarm of young hoppers migrating past a newly planted tree. Note the definite avoidance of the shadow cast on the ground by the roll of hessian.

Adults were seen flying through open timber, but they did not enter dense timber. One dense swarm was found margining a belt of trees, and only two or three paces into the timber there was complete freedom from grasshoppers. Egg-beds were frequently found adjacent to timber areas following migratory flights in that direction.

Swarms were relatively dense when mating occurred, while for oviposition the females congregated so closely together that sometimes the ground was almost obliterated from view.

Peculiar Feeding Habits.

One station-owner attempted to protect his vegetable patch from invading grasshoppers by covering the beds with hessian. Holes were subsequently eaten through this hessian cover.

A patterned linen cloth was washed and hung in the open to dry while a flight was in progress. A number of insects settled on the wet cloth and in a short time it was completely ruined. The cloth was of white linen patterned in blue and black, and in feeding on it the insects exhibited what almost amounted to a colour preference in that the darker portions were predominantly the worst affected.

Number of Generations in South-eastern Queensland.

Unfortunately, it was not possible to watch the insects breeding, in the districts affected, for a complete year. Nevertheless, there can be no doubt that not less than three complete generations are possible in South-eastern Queensland in a single year. The following records for 1934-35 can be explained only on this basis:—

TABLE 3.

Date.	Record.	Egg Period.	Larval Period.	Generation.
1934. April–May	Adults oviposited	Approx. 4 months	..	..
Early September ..	Nymphs emerged			
Early September ..	Nymphs emerged	..	Approx. 7–8 weeks	I.
Late October	Adults on the wing			
3rd November ..	Adults oviposited	19–21 days	..	..
22nd November ..	Nymphs emerged			
22nd November ..	Nymphs emerged	..	Approx. 6 weeks	II.
1935. 4th January ..	Adults on the wing			

Assuming that adults on the wing in January laid eggs, their progeny—the third generation—would develop in nine to eleven weeks, yielding adults capable of oviposition early in April, thus returning to the period with which the table commenced.

Natural Enemies.

At intervals several species of birds, including ibis, starlings, plain turkeys, and crows, fed on the hoppers. The ibis appeared the most important, particularly in the Kooroongarra locality. Several large flocks visited the swarms day after day and fed actively. Quite often the presence of the birds facilitated the location of hopper swarms at a distance.

Birds are, no doubt, useful in destroying noxious insects, but in the face of an epidemic occurrence they are quite incapable of effectively reducing the pest population.

By far the most important insect enemies of the grasshoppers were the Scelionid egg parasites. Two species—*Scelio chortoicetes* Frogg. and *S. fulgidus* Crawf.—were collected. Occasional egg pods at Kooroongarra in September were parasitised to the extent of 60 per cent. to 80 per cent., but these were apparently exceptional, for the total parasitism in the egg-beds, as judged by the subsequent hopper emergence, could not have been considerable. At Goondiwindi up to thirty adult Scelionids per square yard were found on certain egg-beds during the spring. Again, in spite of this, very heavy hatchings of hoppers occurred.

These Scelios, however, accomplished outstanding work on the eggs laid in November. One example may be quoted. Female grasshoppers oviposited on the same site for the two successive generations. From eggs laid in the autumn the normal heavy hatch of hoppers occurred in the spring, and at the time of emergence a number of Scelionids were seen. Heavy oviposition recurred in November, and parasitism was so effective that only a few hoppers emerged. Scelionids were exceedingly active and numerous over the whole egg-bed of some acres. During November the Scelionid wasps were readily found wherever heavy oviposition occurred.

Two species of Tachinidæ were bred from the plague grasshopper—*Locustivora pachytyli* (Skuse) and *Helicobia australis* (J. and T.)—larvæ being found in both immature and adult grasshoppers from Goondiwindi. Among some swarms the percentage of parasitism appeared to be high. The degree to which this form of parasitism subsequently impaired reproduction was not investigated, but otherwise the effect of the parasitism was not particularly marked. Occasional parasitised individuals were certainly sluggish, but many apparently normal insects contained well-grown maggots.

A number of swarms of both adult grasshoppers and nymphs were infested by red mites, and in one instance the bulk of the population was attacked. The insects so infested were definitely sluggish.

[TO BE CONTINUED.]

CODLING MOTH CONTROL.

In the February issue of this journal a brief note on codling moth control was published, although the advice it contained was obviously out of season. The note was originally prepared for and published in another departmental publication—*The Weekly News Bulletin*—for use during the week ended 17th October last, when it had a seasonal value.

Although unseasonable at the time of publication in the *Queensland Agricultural Journal,* the advice the note conveyed might well be kept in mind as applicable next spring. A further reminder will, of course, be published before then.

Queensland Weeds.

JOHNSON GRASS AND WILD SORGHUM.

C. T. WHITE, Government Botanist.

Johnson Grass (*Sorghum halepense*).

DESCRIPTION.—A robust, perennial grass, mostly 3-5 feet high, with numerous well-developed white underground stems or runners; each runner with numerous short internodes and capable when cut into small pieces of developing into new plants. Leaf-blades 12 to 15 inches long, mostly under ½ inch wide; uppermost leaf-sheaths about 6 inches long, the lower ones successively shorter; ligule silky-hairy. Inflorescence (seed-head) 9-12 inches long and almost 8 inches across. Spikelets of two sorts, the smaller, narrower ones male or sterile, the others and larger, female or fertile. Fertile spikelets scarcely ¼ inch long, densely covered with silky hairs, awn brown, bent and twisted, over half an inch long, soon falling off.

Distribution.—A native of the Mediterranean region, now naturalised in most warm temperate and sub-tropical countries.

Botanical Name.—Sorghum, probably from Sorghi, an Indian name for *Sorghum vulgare; halepense,* Latin, meaning a native of Aleppo, Northern Syria.

Common Name.—The origin of the name Johnson Grass is explained in the following way by Ada E. Georgia in "A Manual of Weeds," New York, 1914:—"About 1830 there came to Governor Means, of South Carolina, a message from the Sultan of Turkey, requesting that an instructor in the art of raising cotton be sent to the Ottoman Empire. Two or three years later, when the instructor returned, he brought with him the seeds of a number of plants that seemed to him to be of economic value, and among them was this grass. An Alabama planter, Colonel William Johnson, while on a visit to South Carolina, became interested in the new plant, obtained a quantity of seed, and raised it extensively on his plantation in the fertile bottom lands of the Alabama River."

Properties.—Like most of the Sorghums, Johnson Grass contains a prussic acid-yielding glucoside. The glucoside is most developed in the young stages, particularly second growth, and its use as a fodder unless cut and allowed to wilt for a short time is always attended with a certain amount of risk.

Eradication.—As in all plants with an underground food storage system, all attempts at eradication should be aimed at keeping down the leaf growth by cutting or mowing, as the vigour of the underground runners depends on the leaves. Pigs are especially fond of the white, succulent, underground parts of Johnson Grass, and are useful in keeping the pest in check, but as the glucoside is present in these as well as the green leaves and stem there is always a certain amount of risk in allowing pigs to feed on them.

Botanical Reference.—Sorghum halepense (L.), Persoon Synopsis Plantarum I., 101 (1805).

Plate 134.
Johnson Grass (*Sorghum halepense*).

Plate 135.
Wild Sorghum (*Sorghum verticilliflorum*).

Wild Sorghum (*Sorghum verticilliflorum*).

Description.—A tall, robust perennial grass, 6-8 feet high or more, the leaves and stems often stained a purplish red by bacterial infection; not producing white, underground runners as in Johnson Grass, but perennial through buds developed at the base of the stems. Leaf-blades 9-18 inches long, $\frac{1}{2}$-$\frac{3}{4}$ inch broad, uppermost leaf-sheaths about 1 foot long, lower ones successively shorter; ligule silky-hairy. Inflorescence (seed-head), 12-18 inches long and about 12 inches across. Spikelets of two sorts, the smaller, narrower ones males or sterile, the larger, plumper ones female or fertile. Fertile spikelets $\frac{1}{4}$ inch long, covered with brown, silky hairs; awn brown, bent and twisted, $\frac{1}{2}$ inch or more long.

Distribution.—A native of Africa, where it has a wide range through tropical Africa to Natal. It is also found in Madagascar, the Seychelles, and the Mascarenes (the Mauritius Group of Islands). It is now naturalised in many warm countries. It has been established in Queensland for many years, and is much more abundant than *Sorghum helepense* (Johnson Grass), with which in the past it has been confused.

Botanical Name.—*Sorghum* (see under Johnson Grass); *verticilliflorum* from the Latin *verticillus,* the whirl of a spindle, and *flos, floris* a flower, in reference to the lower branches of the panicle or seed head being arranged in whorls.

Common Name.—Usually confused with Johnson Grass, but is a much more robust grass without underground runners. Wild Sorghum is, perhaps, the most commonly applied vernacular.

Properties.—The grass, according to tests carried out at the Agricultural Chemist's Laboratory (Brisbane) is one of the strongest cyanogenetic (prussic acid yielding) species, and its use as a fodder is therefore always attended with a certain amount of risk.

Eradication.—Unlike Johnson Grass, this species does not possess rhizomes, which have the power of growing from small underground pieces into new plants. It is not a particularly aggressive grass in cultivation areas, and calls for no special methods of eradication. It is very common round cultivation headlands, along railway embankments, etc.

Botanical Reference.—*Sorghum verticilliflorum,* O. Stapf. in Flora of Tropical Africa, Vol. IX., p. 116. (1917.) *Andropogon verticilliflorus,* Steudel Synopsis Plantarum Glumacearium 1, 393. (1854.)

TALKS ON ECONOMICS.

How did you vote on the Marketing Referendum? Why did you? Anyway, some people thought it was the most puzzling question that has ever been put before Australian electors. Certainly it was difficult to come to a conclusion on the matter without some knowledge of general Australian economics. Some simple, clear talks on various problems of Australian economics would be worth while reading. And any of our readers may get talks like this, simply set out and clearly typewritten. Write to-day to the Director of the Department of Tutorial Classes, corner Edward and Ann streets, Brisbane, who has some excellent talks available on Australian economics and economic geography. While writing ask for a list of all the subjects on which typewritten talks are available. The fee for a series of twenty-one lectures is only 8s. 6d., and for that fee you may also borrow books on the particular subject of the talks.

Review of Results from Fertility Trials in North Queensland.*

H. W. KERR.

Introduction.

IN 1929 the Bureau of Sugar Experiment Stations instituted the farm fertility trial project. To date, we have the results of seven years' effort, and it would appear opportune to review these results, for the purpose of extracting any general conclusions which appear warranted, and to indicate in which directions our future efforts should be concentrated.

It is recognised that the results obtained from an experimental area on one farm are specific for that area alone; but at the same time, when we have accumulated similar evidence from a series of such trials, on areas of similar soil type, we are justified in generalising our advice for the soil type as a whole. After all, our recommendations are based on but three classes of mixed fertilizer, which are, at the present time, adequate for our needs; as we cannot in the present state of our knowledge, draw finer distinctions between fertilizers of similar composition, or even designate to the nearest 50lbs. the quantity of fertilizer per acre which should be applied from year to year, no further refinement is demanded. We must remember, also, that the quantity of fertilizer which a farmer purchases is often governed not only by the needs of his land, but by the length of his purse.

Soil Types.

Our soil survey officer has provided us with maps of the Northern cane soils, and has classified them largely on the basis of their origin and mode of formation, into a number of major types, with minor variants. The major types are:—

(1) Granitic alluvials,
(2) Granitic residuals (usually sandy and gravelly loams),
(3) Schist alluvials,
(4) Red schist residuals,
(5) Red volcanic loam.

They occur in greater or less amounts, in all areas from Mossman to Tully: there are no schist alluvials in the Tully or Babinda areas, while red volcanic loams are absent from the Mossman and Tully districts.

These distinctive types have been kept in mind in the selection of sites for fertility trials, so that at the present time we are in possession of information regarding each major series, in addition to more specialised knowledge on minor variants.

(1) Granitic Alluvials.

This class embraces many of the river and creek flat soils of the Mossman, Mulgrave, Babinda and Innisfail districts. In their behaviour towards fertilizers, we find that they are frequently acid, and in need of

* Reprinted from the current "Cane Growers' Quarterly Bulletin" by courtesy of the Director, Bureau of Sugar Experiment Stations, and with acknowledgment to the Queensland Society of Sugar Cane Technologists.

liming. They also exhibit deficiencies in available phosphates and nitrogen, but are usually well supplied with available potash. An excellent example of this soil type is the Tropical Agricultural Station, South Johnstone, which was conducted for many years as a sugar experiment station. Our experiments showed consistently good and profitable results from the frequent use of lime, and the consistent applications of fertilizers rich in phosphates and nitrogen.

A number of our farm trials have been located on this type. A summary of the results gives the following average increase from modest application of nitrogen (as sulphate of ammonia), phosphoric acid (as superphosphate) and potash (as muriate) :—

TABLE I.
Granitic Alluvial Loams.

Yield Increase Due to—	Plant Cane.	Ratoon Cane.
	Tons.	Tons.
Nitrogen (N)	2	5
Phosphoric acid (P)	5	6
Potash (K)	1	2
Total	8	13

The consistency over a range of trials confirms the general recommendations of the Bureau, for the use of Sugar Bureau No. 1 fertilizer mixtures, which are rich in phosphates and poor in potash. It will be observed that there is a marked increase for nitrogen on ratoons, whereas the plant cane response is relatively slight. Sulphate of ammonia should therefore be applied consistently to ratoons, even when green manuring has been practised prior to planting.

We have also the results of quantitative fertilizer trials on this soil type, which were designed to tell us the most profitable application per acre.

Though these are insufficient to allow of any fine conclusions, they indicate the need for the following :—

—	Plant Cane.	Ratoons.
Initial treatment.. ..	4 cwt. per acre, Sugar Bureau No. 1 Planting Mixture in drill	4 cwt. per acre, Sugar Bureau No. 1 Ratooning Mixture, when ratooning
Top dressings	2 cwt. per acre, sulphate of ammonia as top dressing (if farmer has not green manured)	3–4 cwt. per acre sulphate of ammonia, in two top dressings; the heavier application for old ratoons

(2) Granitic Residuals.

This class includes the characteristic gravelly loams of Babinda and Tully, as well as smaller areas of red granitic slopes at the foothills of certain districts. In spite of their low water-holding capacity, they are productive types in high rainfall areas, provided liberal fertilizer applications are made to maintain the available plantfood supply. In

their behaviour towards the individual nutrients, they are rather similar to the granitic alluvials, as is shown in Table II.: this summarises the results to date on the gravelly soils.

TABLE II.

GRANITIC GRAVELLY LOAMS.

Yield Increase Due to—	Plant Cane.	Ratoon Cane.
	Tons.	Tons.
Nitrogen (N)	4	6
Phosphoric acid (P)	2	2
Potash (K)	0·5	2
Total	6·5	10

It will be observed that these soils give generally a higher plant cane response to sulphate of ammonia than do the alluvials; this is to be expected, when it is remembered that these soils are very deficient in humus. The yield increase due to phosphate is relatively slight, and we have some indication of a slight potash deficiency in ratoons.

On the basis of quantitative trials carried out on this soil type, we offer the following general recommendation:—

—	Plant Cane.	Ratoons.
Initial treatment..	3–4 cwt. per acre, Sugar Bureau No. 1 Planting Mixture in drill	3–4 cwt. per acre, Sugar Bureau No. 1 Ratooning Mixture, when ratooning
Top dressings	2–3 cwt. per acre sulphate of ammonia as top dressing (if farmer has not green manured)	3–4 cwt. per acre sulphate of ammonia, in two top dressings

(3) Schist Alluvials.

This soil type is generally not "pure" in character, as the silts from which it is built are usually of mixed granitic and schist origin; we therefore apply the name to soils which are purely *or* predominantly of schist origin. Soils of this class constitute some of the most highly productive lands of the North.

Due probably to the lack of uniformity in the parent material from which these soils are formed, they exhibit marked variations in their behaviour towards artificial manures. It is generally true that they display definite nitrogen deficiency, and some remarkable yield increases are obtained from applications of sulphate of ammonia. The remarks for residual schist soils should be consulted for further comment on schist loams in general.

(4) Red Schist Residuals.

This soil type is one of the major cane soils of North Queensland. The general colour is red, and for this reason they are often confused

with volcanic loams: indeed, the line of demarcation is particularly difficult to define where both types exist side by side. At times a moister variation of the major type exists, and this is brown in colour: where conditions of poor drainage occur, a characteristic white soil is obtained.

These soils as a class have been studied more extensively than any other type in North Queensland. This is the result of the lack of agreement obtained from areas even in close proximity. They are uniformly deficient in humus, and consequently, in available nitrogen: they therefore give good response to sulphate of ammonia. In certain cases an application of 4cwt. per acre has given increases ranging from 10 to 17 tons of cane per acre, with ratoons. As regards their reaction to phosphates and potash, we find sometimes one, sometimes the other is dominating, while on other occasions, both are in substantial demand.

The summarised results of Table III. illustrate this fact.

TABLE III.

SCHIST LOAMS.

Yield Increase Due to—	Plant Cane.	Ratoon Cane.
	Tons.	Tons.
Nitrogen (N)	3·4	8·4
Phosphoric acid (P)	2·5	2·0
Potash (K)	2·1	3·0
Total	8·0	13·4

These averages show clearly the need for sulphate of ammonia on this soil type, on both plant and ratoon crops: as regards phosphate and potash, the *average* increase is sensibly equal for both plantfoods: but if we should consider *extreme* cases, we have the following comparison, for trials located not more than one mile apart, on first ratoon crops:—

Increase Due to—	Farm "A."	Farm "B."
	Tons.	Tons.
Nitrogen (N)	3·8	12.8
Phosphoric acid (P)	4·8	2·8
Potash (K)	0·4	7·0

To quote another example, from a trial on red schist soil at South Johnstone, we found:—

Increase Due to—	Tons.
Nitrogen	2.2
Phosphoric acid	9.2
Potash	1.5

To generalise, then, we would offer the following advice; this will cover probably 75 per cent. of schist lands. It is best, however, for farmers on this class of soil to submit a sample for chemical analysis, as this can be relied upon to tell us the true state of the soil with reference to available phosphate, and to indicate the need or otherwise for potash; a specific recommendation then becomes possible.

—	Plant Cane.	Ratoons.
Initial treatment.. ..	3–5 cwt. per acre, Sugar Bureau No. 2 Planting Mixture, in drill	3–5 cwt. per acre, Sugar Bureau No. 2 Ratooning Mixture, when ratooning
Top dressings	3 cwt. per acre sulphate of ammonia, in two top dressings	3–4 cwt. per acre sulphate of ammonia, in two top dressings

(5) Red Volcanic Loam.

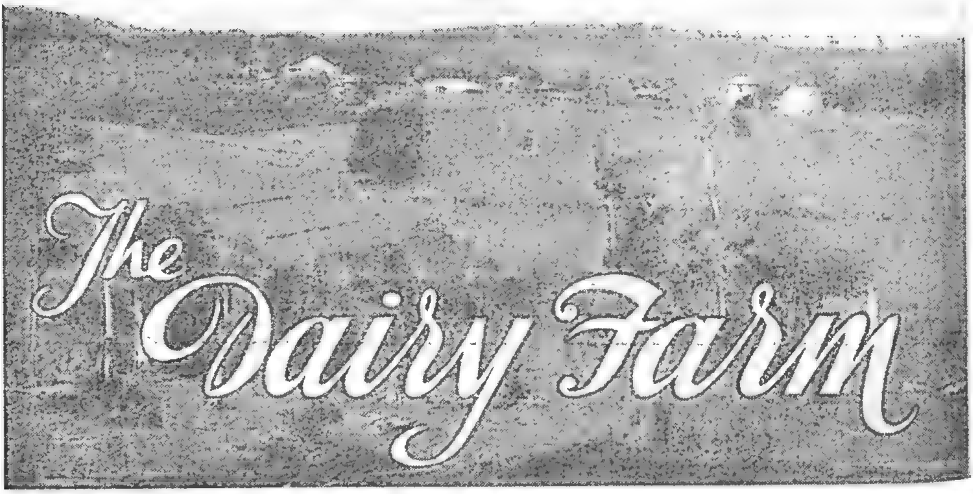
Substantial areas of this soil type are found in the far North, notably in the Innisfail and Babinda districts. The virtues of this soil from the point of view of its tillage qualities have frequently been extolled. It is also very interesting in its reactions to fertilizer, as it is the chief soil type which shows a definite and consistent potash deficiency: it is rarely if ever lacking in available phosphate, while yield-increases from sulphate of ammonia, even on ratoons, are not outstanding.

Applications of from 300-500lbs. of muriate of potash per acre have produced crop increases ranging from 6 to 14 tons of cane per acre, on plant cane. The highest increase was recorded on a field characterised by the presence of "sterile patches" which is so frequently strong evidence of potash deficiency on soils of this type.*

With ratoons, the crop increases for progressively heavier applications of potash are not so marked as for plant cane: and it would appear that the consistent application of 2cwt. of muriate of potash per acre is sufficient for customary yields. It is interesting to note, also, that the use of potash on this land influences the C.C.S. of the crop grown thereon, and farmers may expect permanent benefits from the practice. Our recommendations for red volcanic soils are as follows:—

—	Plant Cane.	Ratoons.
Initial treatment.. ..	4–5 cwt. per acre, Sugar Bureau No. 3 Planting Mixture, in drill	4–5 cwt. per acre, Sugar Bureau No. 3 Ratooning Mixture, when ratooning
Top dressings	2 cwt. per acre, sulphate of ammonia as top dressing (if farmer has not green manured)	2–3 cwt. per acre, sulphate of ammonia as top dressing

* This should not be confused with similar patches on alluvial country; they usually denote excessive acidity and phosphate deficiency.



Comfort for Cows.

WITH the dairy herd, a cold rainy spell always results in a falling off in production and—equally important but often overlooked—a falling off in condition. This may be regarded as an unavoidable evil, or, what is more likely, the dairyman blandly ignores it in the belief, probably, that the growth of feed after the rain will soon restore production to its original level or even raise it. But is such a temporary setback unavoidable? It is certainly not economical.

The remedy is not a matter of any great expense, or even of any great work. A corn-sack rug for each cow will mean the difference between a hungry herd, huddled into some inadequate shelter, and one out feeding even through the heaviest of showers, or on the coldest day. Two sacks sewn together lengthwise for the body of the rug and one across the withers and shoulders, short lengths of rope or cord for a breeching with ties under the belly and brisket are all that are necessary; about two shillings worth altogether, but a lot of comfort for a good cow. Although it won't be really waterproof, unless treated, until it has been in use some time, it is proof against the wind; and that is the real object, not to keep the cow dry but to keep her warm.

The usual objection is the labour of rugging and unrugging daily. Rugs are required on the cows day as well as night while the rain or cold weather lasts. When rugging in winter time the rugs should be removed on any fine day, but should be left on when the cold westerly winds are blowing. Any real herdmaster will rug throughout the winter, having once seen the comfort it provides for his cattle, in spite of the time taken in rugging and unrugging.—A. McDOWAL, Inspector of Dairies, Stock, and Slaughtering.

Cane Soils of North Queensland.*

N. J. KING.

THE canegrowing soils of North Queensland were discussed at the last Cairns Conference.† The maps submitted at that time were based on a preliminary soils survey carried out in 1930. During the latter half of 1936 the writer made a more detailed survey of these far northern areas supplying the Mossman, Hambledon, Mulgrave, Babinda, and Goondi Mills. The work will be continued as opportunity offers.

Several alterations and amendments were made in each mill district and the increasing volume of information being collected by the northern field officer, and per medium of fertility trials, makes possible a more detailed study of these soils. At the same time field experimental programmes are being vigorously pursued by several of the mill staffs, and the writer is particularly indebted to the staffs of Mulgrave and Goondi Mills, whose co-operation was of considerable value. The soil analytical survey initiated by the former mill should be of inestimable value to the suppliers in furtherance of an intelligent fertilizer programme.

Mossman.

Sugar cane agriculture in this area may be described as being carried out in a series of valleys and flood plains. Practically the entire area is alluvial, with only small agricultural development on the hillsides. On this account the cane area is not continuous. The more fertile land has been selected and assigned, leaving undisturbed poorer tracts of forest country between such fertile valleys. The flood plains of Whyanbeel and Saltwater Creeks, Mossman and Little Mossman Rivers, Cassowary Creek, and the Mowbray River and their tributaries cover the cane producing areas of this district.

Geologically, the alluvial soils are derived partly from schists and partly from granite. The influence of the latter is not noticeable except in the Whyanbeel Valley and on the Syndicate line. In these places the soils are usually gravelly—the small quartz particles from the granite having their influence in giving the soils an open structure of unmistakable granitic origin. In all other cases the Mossman alluvials are developed from schists, but during the processes of soil formation and flooding much mixing has undoubtedly taken place. It is probable that the large tracts of non-gravelly country are mixed schists and granitic alluvials, the gravel having separated out as the flood waters moved more slowly. The gravel is therefore found near stream banks or at the base of granite ranges.

The characteristics of these Mossman alluvial soils are (1) their general acidity, (2) fine particle size—they might be classified as a fine sandy clay-loam, (3) great depth of soil without change in structure, (4) uniform buff colour, (5) good moisture holding capacity, and (6) fair drainage. The soil surface is inclined to set somewhat after rain owing to the very fine sand present, but the crust is easily broken by light cultivation. The fertilizer requirements are firstly lime in most cases, and then applications of Sugar Bureau Mixture No. 1 with top dressings of sulphate of ammonia. In most fertility trials on this soil type excellent response has been obtained to phosphate and nitrogen,

* Reprinted from the current "Cane Growers' Quarterly Bulletin" by courtesy of the Director, Bureau of Sugar Experiment Stations, and with acknowledgment to the Queensland Society of Sugar Cane Technologists.

† Some notes on the Soils of the North Queensland Sugar areas, by G. Bates.

with very few instances of gains from potash. Much money is being wasted annually in this district by indiscriminate fertilizing. It should be borne in mind that potash is one of the most expensive ingredients of mixed fertilizers and that soils of the Mossman alluvial type do not require a mixture rich in potash.

Occasionally one finds in these alluvial areas patches of whitish soils which appear to have all the general characteristics of the buff type, except colour. These whitish patches are usually associated with bad drainage, and should be treated as a poorly-drained area. The influence of drainage will be noticed in the improvement of crops and the gradual disappearance of the white colour.

The other soil types of the area which appear in small sections are (1) red schist, (2) red granitic, (3) talc schist, (4) stony schist alluvial, and (5) chocolate sandy soils. Small areas of red schist soil occur on hillsides on the edge of Saltwater area, on Bonnie Doon Estate, along Cassowary Creek, and in the Mowbray Valley. The red granitic soil covers only a small area on the north-west corner of Mango Park Estate. The talc schist soils occur on the south bank of the Mowbray River and the stony schist alluvials along Spring Creek.

The chocolate sandy soils occur near Mossman Beach. The most important of these types is the red schist, and this is discussed as a major soil type in the Hambledon area.

Hambledon.

In this Mill area cane growing is confined to three major types (1) the Barron alluvial, (2) the red schist, and (3) the ancient buff alluvial which is in most respects similar to that at Mossman.

The Barron alluvial soils can be classified as among the richest in Queensland. Their origin is bound up in the red volcanics of the Tableland, and the granites and schists of the Barron gorge. Almost annual flooding keeps up the fertility, particularly in regard to potash, but fertility trials have shown responses to phosphates (as with all other alluvial soils) and a marked crop reaction to nitrogen. There are many textural variations within the type, from very sandy soils to very heavy clays, but the average is a sandy loam of excellent texture and considerable depth. Moisture holding capacity is good. At about 18″ the soil becomes heavier, but not so clayey as to impede good drainage.

The red schist soils form, by area, the most important type of this district. They extend through Redlynch and Jungara up to the Intake on each side of Freshwater Creek; also through Edgehill and down to Wright's Creek on the east slopes of the range. Similarly most of the soils in Sawmill Pocket fall within this type. These red soils are not volcanic though frequently misnamed as such. Their chief characteristics are (1) reddish colour, (2) considerable depth without a marked subsoil, (3) droughty nature, (4) peculiar reaction to fertilizers. Their red colour is due to iron oxide, which varies from 2 per cent. to 12 per cent., the higher figures being obtained in the Redlynch area (*cf.* red volcanic soils in which iron oxide is between 22 and 25 per cent.). The droughty nature is associated with low clay content giving a poor moisture holding capacity. Fertility trials on red schist soils from Hambledon to Tully have given puzzling results. Always a response to nitrogen is obtained, but similar soils on two adjoining farms will sometimes give response to potash in one case and to phosphate in the other. This is explained by

the northern field officer (Mr. Bates) as being due possibly to previous farm history. In the early days of cane farming the only fertilizers used were meatworks, bone, and offal—all rich in phosphates. The stage was eventually reached when potash deficiency developed and a response to potash would naturally result. On newer farms the normal phosphate deficiency of these soils and fair potash content manifests itself in giving phosphate responses to fertility trials. Advisory work on such lands is therefore intimately bound up with previous agricultural history. The chief defect of these soils is their low water holding capacity, and every effort should be made to improve this factor by a programme of green manuring and trash conservation.

The ancient buff alluvial soils are similar in most respects to those in the Mossman area, but are generally less acid; a similar fertilizer treatment is recommended.

Small areas of other soil types exist. The red volcanic soil occurs at Greenhill Estate and responds to a mixture rich in potash and nitrogen—as do other red volcanic soils. White soils occur on the flood plain of Skeleton Creek in the neighbourhood of Robert's Road, and in small areas at Sawmill Pocket. A mixed brown soil derived from admixture of red schist and alluvial occurs near the Carivonica School and just north of White Rock on the main road.

Mulgrave.

It is difficult to separate this from the previous mill area by any sharp line of demarcation. The soil types continue unbroken through each area. The red schist, ancient alluvial, red volcanic, and mixed schist-alluvial soils all occur in this area also. The recent alluvial soils along the flood plain of the Mulgrave can be closely correlated with those of the Barron. The only new soil type is the granite alluvial occurring from Aloomba to Fishery Creek.

The red volcanic soils in this area occur (1) just opposite the Experiment Station at Meringa, (2) a small development in Portion 65, parish Grafton, and a large tract on the south side of the Mulgrave in the upper part of the valley. Another small area also occurs in the Little Mulgrave. These soils are renowned for their excellent tilth, ease of cultivation, great productivity, and response to potash-containing fertilizers. They are also well known for the grub damage occurring thereon. They are well drained, but owing to their high clay content do not suffer from drought to the same extent as the red schist soils. Sugar Bureau Mixture No. 3, with sulphate of ammonia, is the recommended fertilizer treatment. The area opposite the Experiment Station is surrounded on all sides by red schist soil, and owing to the similarity in colour it is difficult to differentiate the two types. Three samples taken here show by analysis the gradation from the red volcanic to the red schist.

Soil Type.	pH (Water Suspension).	Avail. P_2O_5	Avail. K_2O per 100 gm.	Fe_2O_3
		p.p.m.	M.E.	%
Red volcanic	6·8	245	·40	18·6
Mixed volcanic and red schist ..	6·6	125	·30	15·9
Red schist	6·7	54	·37	6·5

The granitic alluvial soils first appear in the gorge south of the Pyramid and extend west and south through Charringa, Meerawa, to the southern boundary of the mill area at Fishery Creek. These soils contain much fine quartz gravel, but also have a good clay content and moisture holding capacity. Much of the land of this origin is even swampy and unsuitable for cane production. Such soils respond to nitrogen and phosphates, there being usually sufficient potash present from decomposition of felspars and mica in the granite. It is difficult to detect accurate soil boundaries in parts of this area. From the Pyramid working east one traverses red schist soil, mixed schist and old buff alluvial, buff alluvial, recent Mulgrave alluvium, and on the southern boundary of some of these types occurs the granitic alluvial soil. It is apparent that much soil mixing has developed at the various boundaries, but fortunately all alluvial soils—irrespective of their origin—appear to have similar fertilizer needs. The red schist development disappears at Aloomba, the ranges further south being principally granites and gneisses.

Babinda.

In this mill area the granite alluvials are the principal soil type, and conform in all respects to those encountered in the Mulgrave area. They are for the most part low-lying and rather poorly drained, much of the land being originally under palm swamps. They are of a more or less heavy nature, and, if worked too wet will form hard lumps. Hard-pan formation is common, and excellent results have often been obtained from subsoiling. The soils are almost exclusively acid (pH 3.8 to 5·4 in KCl suspension), indicating that liming should be a general practice. The excessive rainfall of this district is responsible for extensive leaching of the soils, and only systematic fertilizing can keep such lands in a state of high productivity.

On the hill slopes of the area a reddish soil demonstrates the younger granitic soil development *in situ*. These red soils are very gravelly and well drained. They are essentially a skeleton soil of quartz, felspar, and mica particles, the finer products of decomposition being washed away as quickly as formed. In an area of such heavy rainfall there would appear to be little future for such soils, the erosion factor having too great a bearing on their ultimate life.

Large tracts of rich alluvial country exist along the Russell River in the Bucklands Road area and west beyond Bartle Frere. Similar developments occur on the south bank of the Russell between these points. This soil differs from the recent Barron and Mulgrave alluvials in appearance—probably on account of difference in origin—but the fertilizer deficiencies are similar. The soil is brownish, free of gravel, rather heavy in texture, and contains much mica. It is usually acid. The soil is deep, but subject to hard-pan development at plough depth.

Red volcanic soils occur in Babinda area at Harvey's Creek, Happy Valley, Bartle Frere, and near Qunaba Estate on the south bank of the Russell. Of these the best development is at Bartle Frere where fertilizer trials have given consistent responses to potash and nitrogen, up to 500 lb. per acre of the former still showing a profitable return.

Goondi.

This mill area is remarkably compact and extends over only three soil types (1) the Johnstone alluvial, (2) the red volcanic, and (3) the extremely poor Mundoo soils.

The Johnstone alluvial differs in no way from the Russell alluvium except that the colour is somewhat lighter. Texture, origin, depth, and fertilizer responses appear to be similar, and the normal acidity of the North Queensland alluvials is again apparent in this district. Both sides of the Johnstone River contain extensive flats of this alluvial type, and the Goondi area also includes portion of the flats on the north bank of the South Johnstone River. The isolated Innisfail Estate is of similar type. Granite and schist contribute principally to the origin of these alluvials, and as in the case of the more northern river soils, phosphates and nitrogen give good responses. Lime is nearly always required.

The major portion of the Goondi district is covered by the red volcanic type—the largest development of basaltic soil yet encountered. This red volcanic is in no way dissimilar to those met further north either in origin, texture, depth, composition, or response to potash and nitrogen. The soil does not require lime.

The Mundoo red soil—with which must be included another small area at Todd's corner, north of Garradunga—has long been a problem in cane production in this area. Although red in colour, of good tilth, well drained, and subject to the same climatic influences as the rest of the district, this soil fails to produce crops of even average magnitude under the best conditions. Much of the Mundoo country has been allowed to go out of production altogether, and this fallow country cannot support even a poor growth of grass or lantana. Heavier than average dressings of complete fertilizers do not show anything like the response obtained on the adjoining red volcanic soil. A careful examination of this soil—and of the area at Todd's corner—showed the following deviations from the red volcanic:—

(1) Sand was present in the soil.

(2) The clay content was obviously low.

(3) Moisture holding capacity was very low.

(4) Veins of ironstone occurred at varying depths and pieces of quartz sometimes occurred associated with these veins.

(5) Grass and lantana growth on land now out of production was exceptionally poor.

These observations showed definitely that the soil was not a normal red volcanic. Analysis of typical soil samples from Mundoo area and Todd's corner are shown in Table I., and for purposes of comparison is included an analysis of a true red volcanic soil. The figures for phosphates and potash explain the extreme poverty of the soils; the high total iron content is important in its relation to origin. The extremely low phosphate content is also at variance with normal red volcanics, and the depressed moisture equivalent implies a lower clay content. All these factors, combined with field geological observations, led to the following theory for the genesis of this soil. During the flow of a basaltic lava there sometimes occurs the concentration at certain points of the flow of ore bodies associated with quartz veins. In such cases the quartz is usually very friable and can be reduced to sand by the fingers alone. It is thought, therefore, that the Mundoo and Todd's corner soils are developed from such concentration bodies. The presence of so much quartz sand in a basic lava, the abnormally high iron content, and the numerous ironstone veins are thus explained. At Todd's corner the

sand phase is entirely surrounded by the normal volcanic soil, the line of demarcation from poor to good soil being sharply defined. Table I. illustrates some of the analytical figures obtained.

TABLE I.

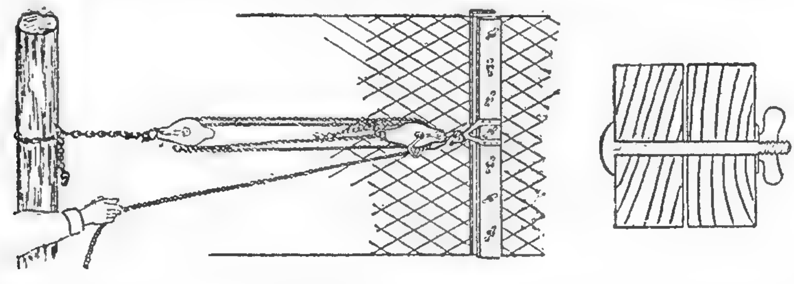
Soil.	Avail. P_2O_5	Avail. K_2O per 100 gm.	Replace CaO per 100 gm.	Coarse Sand.	Fe_2O_3 on Sand-free Soil.	Moisture Equivalent.
	p.p.m.	M.E.	M.E.	%	%	%
True red volcanic	116	0·30	9·7	3·4	20·3	32·0
Todd's Corner	11	0·13	0·5	25·1	34·9	24·0
Todd's Corner	19	0·09	0·4	18·2	36·7	28·5
Mundoo ...	3	0·07	0·4	11·0	30·0	29·4
Subsoil of above	4	0·07	0·1	26·4	34·8	25·6

A WIRE-NETTING STRETCHER.

Wire netting and woven wire fences can be set up perfectly taut with the help of a handy and simple outfit devised by an Argyllshire reader. This home-made stretcher is strong enough to stand any pull and powerful enough to stretch any length of fence required.

The clamp is made of two pieces of oak fixed together with seven ⅜-inch bolts. It is best to have bolts with thumb-screw nuts for the clamp can then be adjusted easily and moved about without being obliged to make use of a screw key.

The blocks used are of a small pattern with 2-inch sheaves, and the arrangement is such that the pull is away from the wire towards the post. The direction of the pull is clearly shown in the drawing given above.



Illustrating the wire-netting stretcher at work, with (right) a section through the clamp to show the arrangement of the bolt and thumb-screw nut.

With a double block as shown there is no slip, and a one pound pull on the rope is equal to four on the wire. The block next the clamp should have a hook on the end to go into the double eye of the clamp. The eye plate of the clamp is arranged by having a plate on each piece. These plates are set in to meet in the middle of the thickness of the wood so that when they are together there is no difficulty in connecting the block.

The arrangement, our reader states, is simple and works easily; every movement of the rope stretches the wire several inches when it is held in a vertical position.—"The Farmer and Stockbreeder (England)."

Maize and Pork Quality.

OWING to its relatively high fat content and the low melting point of its fat, maize can be responsible for the production of soft fat in pork and bacon.

A sweeping statement is sometimes made that "maize fed" pigs are soft as compared with pigs which have been fed on wheat or barley. The statement really needs some qualification so far as Queensland pigs are concerned. A large number could be classed as "maize fed," but they rarely receive sufficient maize to cause soft pork or bacon.

Maize is the most widely grown grain in Queensland, but the pig industry is not dependent on this crop. It is very closely associated with dairying, the pigs being used primarily to consume the milk by-products—separated milk, butter-milk, and whey. Pasture, forage crops, and root crops also form a large part of the diet of pigs on some Queensland farms, and the grains—maize, wheat, and barley—are really only used as supplementary foods.

These points should be borne in mind when reading the advice of some overseas authorities, who state that maize should not constitute more than about 35 per cent. of the grain allowance of pigs. This may be sound advice under English conditions where pigs frequently receive a diet which is about 90 per cent. grain and which usually does not contain milk products, but under Queensland conditions, where the feeding systems are as stated above, there appears to be little danger of pigs receiving sufficient maize to injure their carcass quality.

Most of the pigs produced in Queensland can be classed as "milk fed."—W. A. Downey, Instructor in Pig Raising.

Some Notes on Rat Control in the Mourilyan Area.*

E. H. FOX.

ALTHOUGH a good deal of rat control work had been attempted intermittently by the various Northern pest boards prior to 1934-35, the problem had only occasionally assumed serious proportions, and was usually considered a matter for local, even individual, attention, rather than one of major interest to the industry as a whole.

When it became necessary, therefore, to commence large-scale control operations, the necessary published data for their success were virtually non-existent, and most field investigators had to commence with the "trial and error" method, picking up such information as came their way during the more pressing business of practical attempts at control. It was assumed, at least among the majority of farmers, that a rat was simply a rat; a poison, poisonous; and any foodstuff a suitable medium for carrying the poison.

Undoubtedly there were a number of excellent formulæ in existence, giving lethal dose and recording details of tests, but many of these had been evolved for the destruction of house-rats, and few, if any, had been carefully checked under Queensland field conditions. However, they formed a basis on which to start work, and because of the urgency of the position, it was not long before new clues were being unearthed and exchanged and the classification and description of species under way.

Results at Mourilyan, as elsewhere, have often been confusing; success, for instance, under one set of conditions has often become failure under what appeared to be similar conditions; but certain broad conclusions or at least tendencies can be traced, and may be worth testing in other districts. It should be noted that our captures, alive and dead, suggest that over 90 per cent. of our field rats belong to the *Melomys littoralis* species, also that the destruction of harbourage has been actively pursued simultaneously with poisoning campaigns, and has undoubtedly brought results, and this, combined with the impossibility of evolving a check on field operations, renders more complicated the question of effectiveness of poison baits.

The evidence is overwhelming in favour of continuing poisoning operations, however, under our local conditions; thus the use of thallium-coated wheat has given 100 per cent. kill in dozens of cage tests, packets laid in fields showing extensive rat damage have been opened and the contents eaten, occasionally dead rats having been found, and in many cases damage to cane has ceased—temporarily. Certainly not in all cases, but whilst one such case noted could be passed over as an accident and the second as a coincidence, when it happens fairly regularly it seems logical to assume a measure of success for the method. It was admitted, of course, and still is, that there are probably factors operating which are neither controlled nor understood.

These activities soon pointed to another important question—what constitutes the adequate baiting of a paddock? Our most striking successes had been obtained under conditions of very lavish baiting (of the order of 2,000 baits per acre) and anyone who has attempted

* Reprinted from the current "Cane Growers' Quarterly Bulletin," and with acknowledgment to the Queensland Society of Sugar Cane Technologists.

the baiting of a badly infested paddock of lodged cane will realise the absurdity of putting down a few hundred baits around the headlands of a large paddock. Having once admitted the poisoning method as a handy and more or less effective one for the destruction of rats, it naturally followed that a more regular and complete baiting of paddocks was desirable if it could be accomplished economically.

A three-weekly issue of 1,000 baits for every farm in the area, whether rat infested or not, was aimed at as a minimum, with large reserves for those farmers who, because of extensive damage, either applied (themselves) for more or were advised that they required more. Obviously thallium wheat baits were too expensive to be used on such a scale, so other types were tested, and finally bread and phosphorus baits, as described below, were used for the regular campaigns in dry weather, with packeted wheat as an occasional change and for wet weather application.

The results of our cage tests showed:—

(*a*) One hundred per cent. kill in all cases within twelve hours of the rat taking even the smallest bite.

(*b*) The tinted, or poisoned, face of the bread cube was apparently the most palatable.

(*c*) Baits appeared to retain their palatability and potency after being kept one month in an airtight tin.

(*d*) Baits were still potent after twenty-four hours in the paddock.

The method of manufacture is still being improved, but consists at the moment in slicing large sandwich loaves into twenty-eight to thirty slices, laying them on a board which is constantly being smeared with phosphorus paste (made to Dr. Cilento's formula), dipping the sticky face in a mixture of flour and sugar, and finally cutting the slices into cubes by means of a cheap salad cutter. The cubes are then put into 4-lb. bags, labelled, and packed in air-tight tins for delivery.

It is possible to cut 4,000 baits from a double sandwich loaf, and the fresher the bread the more easily will it be found to cut. Instead of brushing the thick paste (previously warmed) directly on to the bread, it saves time to smear it on a heavy, shining surface, such as marble or a piece of thick glass, by means of a paint brush, and to press the slice down firmly on this. It is also found advisable to carry each process through quickly without any accumulation at each step, because of the rapid drying of the bread, with the consequent difficulty in cutting it.

The salad cutter, costing about 2s., is imply a series of thin sharpened metal discs, 3 inches in diameter, revolving on a common spindle and encased in a metal guard. It is capable of improvement for this work—a heavier and stouter one would handle the crusts better. Indeed, refinements are no doubt possible throughout all stages of manufacture, but the following figures of actual costs will serve to show how cheaply these baits are being prepared. Costs of supervision and delivery are not included. The cost of carriage on phosphorus paste is included, but, if carried freight free, it would reduce this charge from 1s. 8d. per lb. to 1s. 3d., reducing the total cost of baits to about 8d. per 1,000; whilst, if mixed on the premises, this charge of 1s. 8d. per lb. for phosphorus would be still further reduced to 8d. per lb. or less.

Cost of manufacturing 180,000 phosphorus rat baits:—

	£	s.	d.
45 double loaves at 10d.	1	17	6
45 lb. phosphorus paste at 1s. 8d. ..	3	15	0
Labour (youth, 2 days)	0	16	8
Flour and sugar	0	6	0
Bags	0	1	8
Labels	0	3	0
"Clag"	0	0	6
	£7	0	4

or a little over 9d. per 1,000 baits.

Their small cost has enabled us to lay a total of 1,386,000 baits over a comparatively small of approximately 8,000 acres net in nine months, and in the writer's opinion this is lower than the minimum needed for prevention of damage, and considerably lower than that required for clearing up harbourages already heavily infested. Damage throughout the area last year was so low (from whatever cause) that we feel justified in continuing our present methods even more extensively until such time as a better method of control is evolved, or unmistakable proof is forthcoming that we are drawing wrong inferences.

QUEENSLAND SHOW DATES FOR 1937.

May.

Longreach ... 3rd to 6th
Beaudesert—
Show ... 5th and 6th
Bushmen's Carnival ... 7th and 8th
Wallumbilla ... 6th and 7th
Nanango ... 6th and 7th
Dirranbandi ... 6th to 8th
Ipswich ... 11th to 14th
Wowan—
Show ... 11th and 12th
Rodeo ... 13th
Biggenden ... 20th and 21st
Gympie ... 20th to 22nd
Warrill View ... 22nd
Kilkivan ... 24th and 25th
Maryborough ... 25th to 27th
Charleville ... 25th to 27th
Maryborough ... 25th to 27th
Gin Gin ... 28th and 29th
Toogoolawah ... 28th and 29th
Kalbar ... 29th
Childers ... 31st May and 1st June

June.

Bundaberg ... 3rd to 5th
Lowood ... 4th and 5th
Boonah ... 9th and 10th
Gladstone ... 9th and 10th
Marburg ... 18th and 19th
Rockhampton ... 22nd to 26th
Mackay ... 28th June to 1st July

July.

Bowen ... 7th and 8th
Ayr ... 9th and 10th
Rosewood ... 9th and 10th
Cleveland ... 9th and 10th
Townsville ... 13th to 15th
Nambour—
Show ... 15th and 16th
Campdraft ... 17th
Esk ... 16th and 17th
Charters Towers ... 20th and 21st
Laidley ... 21st and 22nd
Maleny ... 22nd and 23rd
Cairns ... 27th and 28th
Gatton ... 28th and 29th
Caboolture ... 30th and 31st

August.

Royal National, Brisbane 16th to 21st
Crow's Nest ... 4th and 5th

September.

Imbil ... 3rd and 4th
Rocklea ... 11th
Innisfail ... 17th and 18th

November.

Murwillumbah ... 3rd and 4th

A Modified Irrigation Method.*

B. TAPIOLAS.

IN a paper on "Irrigation Principles" presented by Kerr at the 1933 Conference,† brief reference was made (Proceedings, p. 104) to a method of "one-side" irrigation, which was being tested in the Burdekin area. The writer has given further close study to the method since that time, and is now able to report that it has been developed into a very satisfactory scheme for both plant and ratoon cane irrigation.

The characteristics of the Burdekin alluvial soils were accurately described by Kerr and Cassidy,‡ and the difficulty in keeping these soils in a well-cultivated state between waterings is one of the biggest problems the farmer has to contend with. The ill-effects of the water on the soil also increases the difficulty of raising satisfactory crops, and this is particularly true of ratoons. The writer has therefore concentrated his attention on a method which would bring about the following improvements:—

(1) Reduction in the number of cultivation operations necessary.

(2) Water economy.

(3) Assistance in the retention of a favourable tilth in the surface soil, by minimising the ill-effects of water and implements.

Early efforts were confined exclusively to ratoons, and an implement was devised which would enable the cultivation of the land to be carried out in a few operations. At the present time, the standard ratooning practice is as follows:—Bumper discing, to create a surface mulch and level the land; ploughing away from both sides of the stools; subsoiling or grubbing; scarifying to level the interspace; preparing water furrows for irrigation; surface cultivation to restore tilth; hilling-up, in preparing water furrows; scarification, &c., after each watering, and the necessary repairing or re-shaping of water ditches before each subsequent irrigation. By the improved method, the number of operations is reduced to the following:—Bumper discing; ploughing away; sub-soiling to 15 inches, and preparing 10-inch furrow close to one side of the cane stools, all in one operation. As many as four light waterings may then be given, before cultivation for weed control becomes necessary, as the manner in which the water is applied keeps the surface soil of the interspaces dry, and the soil tilth is therefore not destroyed. When it becomes necessary to check weed growth, this is done by one operation with the combined implement. By this time the ratoons are well advanced in growth, and thereafter, watering only is necessary.

A brief description of the implement, assisted by the accompanying sketches and photographs, should make the essential features clear. It was built up by the writer from portions of old implements on the farm. To a standard tractor-grubber frame three mouldboard ploughs were attached in a special manner (*see* Plate 136). A pair of 7-inch ploughs placed at a distance of about 24 inches between share points, were so attached as to throw a light furrow *on* to the cane stools; they were set

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* Reprinted from the "Cane Growers' Quarterly Bulletin" with acknowledgment to the Queensland Society of Sugar Cane Technologists.

† Annual Conference of the Queensland Society of Sugar Cane Technologists.

‡ "The Soils and Irrigation Waters of the Burdekin Delta"—Q'land Agric. Jour., 1932, p. 115.

so as to turn the surface 3 or 4 inches of soil, and effectively smother all weed-growth in the cane row. Following the right-hand plough, and set at a distance of about 4 inches nearer the cane stools, is a 10-inch mouldboard plough, which turns a furrow 10 inches deep *away* from the cane row. To the tip of the wing of this plough is attached a leveller, consisting of a horizontal iron bar braced to the grubber frame as shown in the illustration (Plate 136). To balance the implement, and to produce a sub-soiling effect, one grubber tyne with a chisel point is attached on the side opposite from the 10-inch plough, and operating towards the centre of the interspace. The effect of the implement on the soil is shown by the series of sketches (Plate 137). The implement is drawn by a tractor straddling the cane rows.

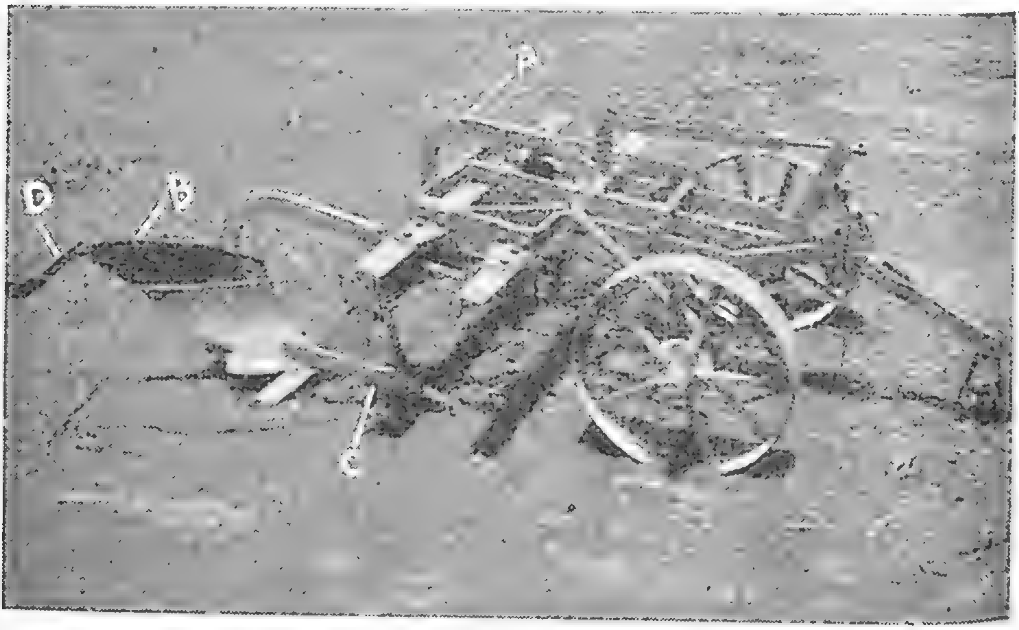


Plate 136.

Illustrating the essential features of the combined implement—A 7-inch plough, B 10-inch plough, C subsoiler, and D leveller, attached to plough wing. *Note.*—One of the 7-inch ploughs is absent from the machine, which was arranged for simplicity in photography.

As the implement is worked in "lands" of eighteen rows, it will be obvious that the central interspace of the land will carry no water furrow; in this interspace the tramline is laid.

It was found, also, that the implement worked very satisfactorily in plant cane. The depth of the 7-inch ploughs was in this case raised by means of the adjustable beam so as to turn only the surface 2 inches of soil from either side, and thus avoid hilling of the cane; the water-furrow was run at a 10-inch depth, as for the ratoons.

After the job is completed the field is free of weeds, and thereafter watering only is necessary. The deep water-furrow ensures deep penetration of the soil and subsoil, while the interspace surface remains quite dry unless rain should fall. Weed growth is therefore prevented, and the cane crop is encouraged to develop a deep rooting system, which means resistance to drought. On lands where rather saline waters are being used the upward rise of water and concentration of soluble salts in the surface soil is also prevented. The fact that cultivation is

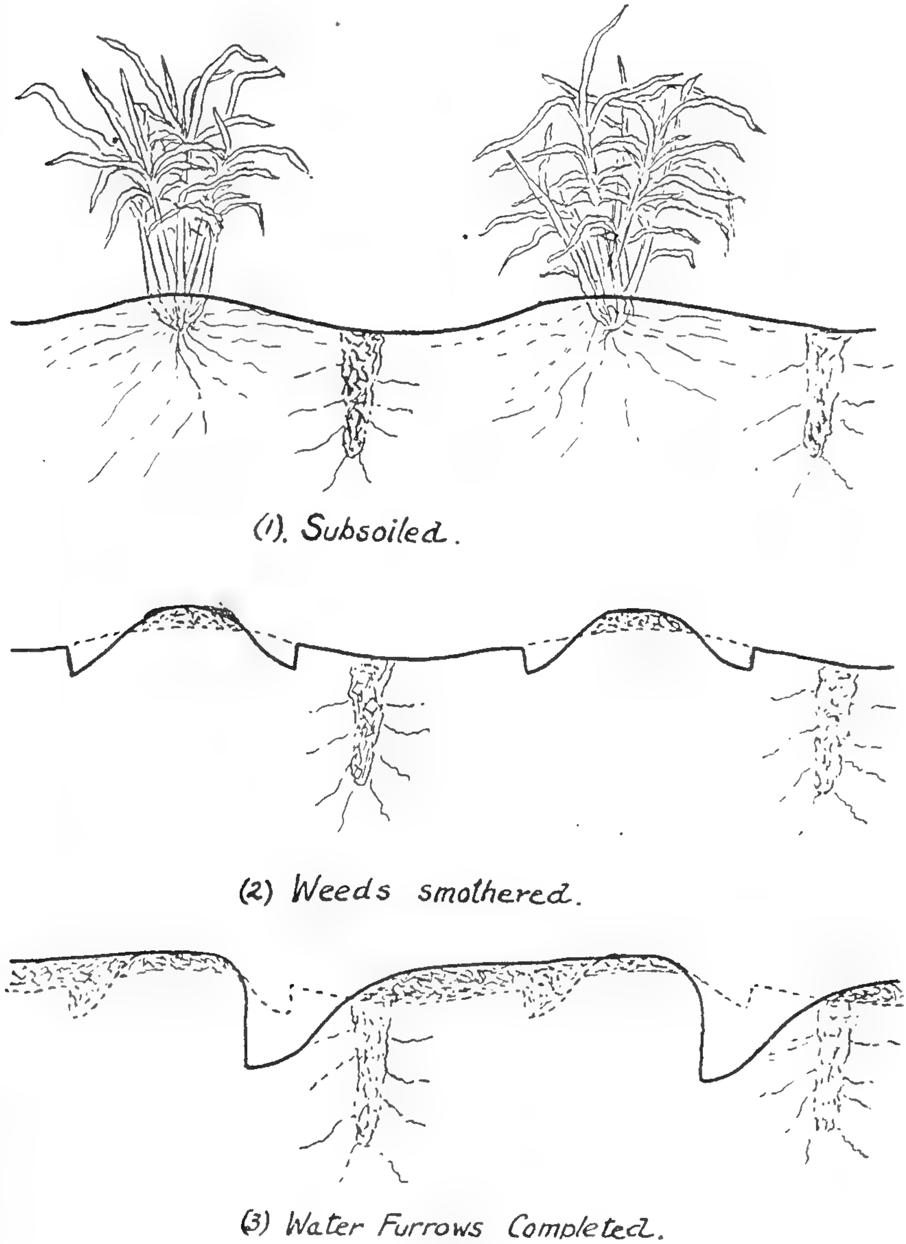


Plate 137.

Showing the successive operations performed by the combined implement.

reduced to a minimum also gives the soil a chance to recover its crumby structure, and makes for a permanent improvement in the tilth of the land. The method markedly increases the area which a man can irrigate daily, while bringing about an economy in water utilization amounting to probably 30 per cent.

The writer would state quite definitely that the modification in irrigation procedure as described above is the biggest forward step he has taken since he adopted the use of artificial manures as a standard practice.

Notes on Farm Horse Rations.*

D. L. McBRYDE.

IN the July, 1935, issue of the *Cane Growers' Quarterly Bulletin* an article on "Feeding Farm Animals" was presented. This arose out of a discussion on farm horse rations which took place at the Bundaberg Conference in April of that year; while many farmers contended that they were able to maintain their animals in good working condition on a ration consisting of "chop," molasses and linseed meal, others were equally emphatic that it was essential to employ maize or some other grain in the feed.

It is well recognised that molasses is the cheapest form of carbohydrate available on the cane farm, and that horses are able to utilize from 6-8 lbs. per day without detriment. It therefore replaces, theoretically at least, the starches supplied by maize, though it is not so rich in proteins.

In order to test the value of this feeding material, the farm horses at the Mackay Experiment Station were placed on a ration of "chop-chop" (or other roughage during the slack season), molasses and linseed meal, with a small addition of mineral lick.

Standard Ration.

The horses are fed three times daily during the working week, twice on Saturday, and once on Sunday, while they are in constant work. At other times, if the paddocks are bare, as is usually the case during winter and spring, two feeds are given daily, except on Sunday, when the animals are fed once. If there is good grass in the paddocks, only one feed is given daily during periods when the horses are idle or in light work.

The components of the feed, and the approximate quantities given are:—

Chop-chop	18 lbs.
Molasses (heavy)	2 lbs.
Linseed meal	1 lb.

These quantities are adhered to by employing measuring tins; in addition, about 1 oz. of lick per day is supplied, to make good any mineral deficiency.

When cane tops are not available, panicum or guinea grass, or both, are chaffed for the horses. This feed is usually cut in sufficient quantity to carry through for two or three days, and except for the needs of the first day, the grass is allowed to dry for a short period before it is taken to the barn.

It is of interest to study the true feeding value of the above-described ration, to determine whether it agrees with the generally accepted standards.

* Reprinted from the current "Cane Growers' Quarterly Bulletin" by courtesy of the Director, Bureau of Sugar Experiment Stations, and with acknowledgment to the Queensland Society of Sugar Cane Technologists.

The analyses of the materials are as follows:—

Feedstuff.	Crude Protein.	Crude Fat.	Crude Fibre.	Crude Carbo-hydrate.
	%	%	%	%
Chop-chop	1·6	0·7	9·0	16·9
Molasses	5·9	—	—	50·0
Linseed Meal	31·4	6·4	10·2	36·8

Making due allowance for the quantity of each in the ration, and the digestibility of each nutrient contained therein, the following amounts of nutrients are given daily:—

Feedstuff.	Dry Matter.	Digestible Proteins.	Total Digestible Nutrients.	Nutritive Ratio.
	lb.	lb.	lb.	
Chop-chop—54 lb.	16·2	0·2	11·3	—
Molasses—6 lb.	4·5	0·1	4·7	—
Linseed Meal—3 lb.	2·7	1·0	2·4	—
Total	23·4	1·3	18·4	1 to 11
Minimum requirements	23·4	1·8	16·9	1 to 8

Discussion.

It will be observed that, without making any allowance for the value of grass obtained by grazing, the animals receive an abundance of dry matter, which is rather rich in total nutrients, but slightly deficient in digestible proteins. It would therefore be an advantage to increase the linseed meal, or substitute portion by a meal richer in proteins and lower in fat.

The accompanying photograph (Plate 138) shows the condition of the animals at the conclusion of the past harvesting season, when they had been fed this ration for eighteen months. It is found that the horses fatten between spells of steady work, but do not soften as their appearance might suggest. They come back into hard trim without any trouble, such as is the case, at times, when horses are given a heavier ration of molasses.

A noticeable improvement since adopting the above feeding systems was that of the condition of skin and coat, which lost all signs of scurf. This improvement was due, undoubtedly, to the linseed meal. Factors operating during the past eighteen months were decidedly against the

well-being of the animals, particularly from May, 1935, to February, 1936, when the horses were without shade or protection from the weather. It might be stated that the horses get little, if any more grooming than would the usual farm horse.

Plate 138.
Farm horses on Mackay Experiment Station, at the conclusion of the harvesting season.

THE USE OF UNSUITABLE FERTILIZER MIXTURES.

The correct fertilization of any crop lies in the ability to supply to the soil those particular foods required by the plant which the soil is unable to supply.

With a view to obtaining this information the Bureau of Sugar Experiment Stations has for the past eight years carried out numerous fertilizer trials on different farms covering a wide range of soils. This collection of a vast amount of data enables us to gauge with accuracy the particular type of fertilizer which will give the most payable return on any particular soil type. In view of this information special fertilizer mixtures have been compounded to suit these soil types, and are known as Sugar Bureau Mixtures Nos. 1, 2, and 3.

It is surprising, after the amount of publicity given these results and the recommendations made, to find that farmers are frequently using mixtures that are both more expensive and unsuitable. A good example is the use of a high-potash mixture on the acid alluvial lands, where a cheaper mixture containing more phosphate and less potash will give a larger tonnage. Another illustration is the use of high-phosphate mixtures on red volcanic soils, which require lots of potash. Such a mixture, while cheap per ton, is expensive in the long run.

If there is any doubt that the correct type of fertilizer is being used, an inquiry directed to the nearest officer of the Bureau of Sugar Experiment Stations will receive attention.

G.B. (in the "Cane Growers' Quarterly.")

Mule Breeding at Bundaberg.

N. J. KING.*

SOME eighteen months ago three jack donkeys were selected in the United States of America, for the purpose of attempting to breed good type mules for work in the Queensland canefields. Two of these animals were purchased by the Fairymead Sugar Co. Ltd., while the third animal was taken to the Burdekin area.

Through the courtesy of the Fairymead Sugar Company, we have pleasure in presenting the accompanying illustration (Plate 139) of a few mule colts which were dropped between early October and late December, 1936. We also reproduce the sire of these animals (Plate 140), a jack of 15.1 hands standard measurement, now eight years old. He was a well-tried animal in Kansas, and produced mules of excellent type in that country.

Plate 139.
A group of mule colts, 3-5 months old, sired by the jack pictured in Plate 140.

At Fairymead Plantation he was mated with 16-hand Clydesdale mares, and to date he has produced 11 foals. The height of the youngsters compares favourably with that of Clydesdale foals of the same age, while their weight is also practically identical. They have been fed uniformly with the usual foals on the plantation, and no variation in treatment has been introduced to date. The outstanding characteristics of the mule colts are their playfulness and inquisitiveness.

It is intended that they be handled and broken in to work as two-year-olds, and put to farm work at the age of three years.

* In the current "Cane Growers' Quarterly." Reprinted by courtesy of the Director, Bureau of Sugar Experiment Stations.

Growers will doubtless be pleased to learn of the early success of this experiment, and will await further results with interest. As only one class of mare has been used for breeding—an attractive type of farm animal—it is not possible to suggest whether the mule type would vary with variation in the type of dam.

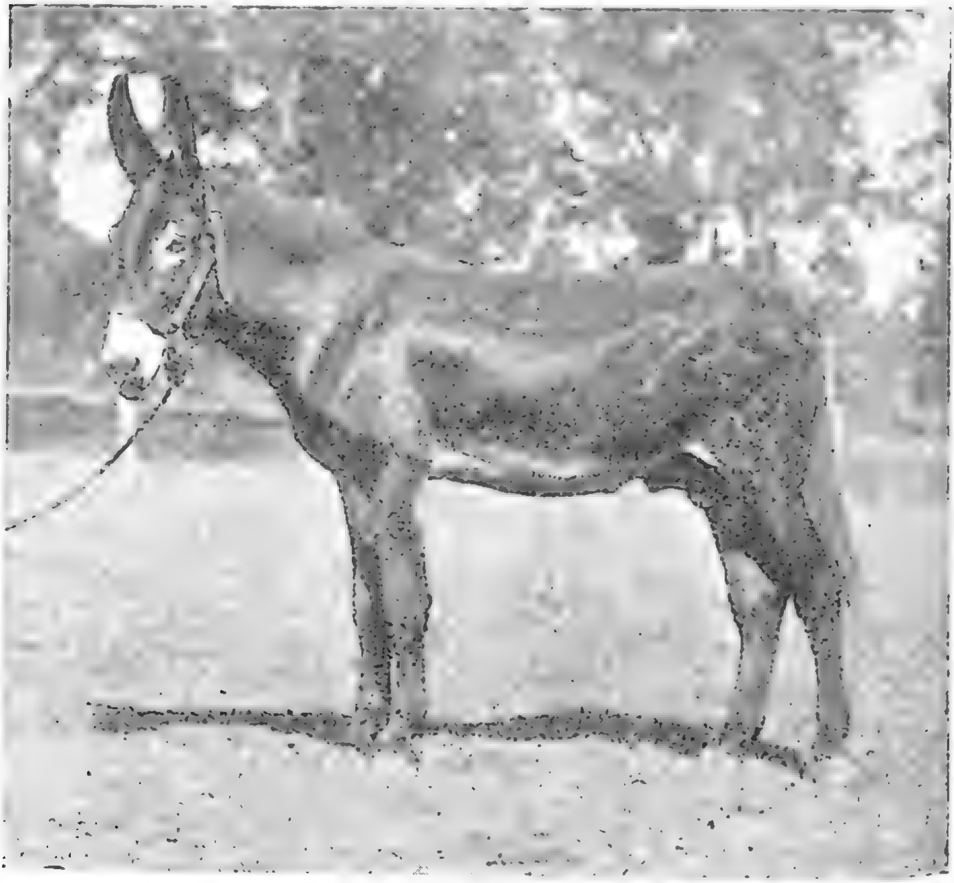


Plate 140.

The sire of the colts pictured in Plate 139. This jack is eight years old and stands 15.1 hands.

THE RISK OF FEEDING ENGLISH POTATO STALKS AND LEAVES.

It has recently been reported to the Department of Agriculture and Stock by one of the veterinary staff that seven dairy cows died suddenly on a farm in the Helidon district. The cows were given a corn bag full of English potato stalks and leaves. A post-mortem examination showed that the rumen was very full and that the potato tops constituted a considerable portion of the contents.

In this connection, it might be pointed out that English potato tops are extremely dangerous feed for stock. They are sometimes used in Europe, and numerous cases are on record there of horses and cattle being poisoned through eating them.

Two poisonous principles are present—both alkaloids—named solanine and solanidine, respectively. They occur to a more limited extent in the ordinary potato peel, and are also present in green potatoes. In the ordinary white, starchy part of the potato they are totally or almost totally absent. Cases are on record, also, in which pigs fed on uncooked sprouted potatoes were affected with slowly progressing paralysis which became complete after about twenty-four hours. Death may or may not result, but in any case the feeding of potato tops and leaves is always attended with risk.

COTTON.

The favourable progress of the cotton crops reported during February has not continued so satisfactorily during March, due to dry conditions and moderate attacks by various insects being experienced in the first half of the month. This is particularly true on the older cultivations, where the severe storms did not penetrate so deeply as on the more open newer cultivations or where cotton followed grassland. Excellent demonstrations of the value of growing cotton in rotation with grassland have been obtained in all districts this season, and undoubtedly a much greater factor of safety can be obtained where such a practice is followed.

The harvesting of the earlier-sown crops has started in all of the main cotton-growing districts, but has been appreciably delayed by the splendid rain group occurring at mid-month when 4 inches or more was received over the cotton areas. Such a soaking rain will promote the formation of a splendid top crop, however, and if frosts are moderately late reasonably good yields may be expected in many districts.

SUGAR.

All cane areas were favoured with excellent growing conditions during the month of March. Heavy tonnages are now practically assured in all areas from Mackay north. The heavy rains of mid-March came in time to give the southern areas a chance to produce a crop before growth is checked by wintry conditions. Even now the situation is critical, and a continuance of favourable conditions essential to ensure a moderate crop.

AUTUMN PLANTING OF ENGLISH POTATOES IN CENTRAL QUEENSLAND.

In Central Queensland, the winter crop of potatoes is normally planted between mid-February and March, and as the growing season is short, harvesting is usually in full swing by June. Climatic conditions are responsible for the comparatively short period between planting and maturity, and also the smaller yields in comparison with those obtained in more temperate regions.

Trials have disclosed that although the tubers attain normal size, the number per plant in this crop is comparatively low, which suggests that yields could be increased by closer planting. This opinion is confirmed by the successful crops obtained in areas where the seed tubers have been spaced 9 inches to 12 inches apart, instead of the wider 12 inches to 18 inches usually practised in the southern districts. As the yield per plant in the winter crop is apparently not reduced by the closer spacing, this method is valuable where small areas are under cultivation, particularly when irrigation facilities are available.

Fertilizer trials conducted on average soils have not shown any marked increase in yields, but further experimental work is necessary before a definite recommendation can be made. However, crops grown on the poorer soils, particularly of old cultivations, should benefit from substantial applications of phosphoric acid and potassic fertilizers.

As heavy rains are likely to be experienced at this period of the year, well-drained, free-working soils are to be preferred. Deep ploughing will be found to assist drainage, besides providing more favourable growing conditions.

If seed potatoes are purchased from outside sources, preplanting treatment with hot formalin or acid corrosive sublimate may be desirable.

Although cut tubers are permissible for spring planting, seed for the autumn crop should definitely comprise whole tubers only.

Attention is also directed to the control of Irish blight and other diseases by means of suitable sprays, full particulars of which may be obtained on application.—W. R. STRAUGHAN, Instructor in Agriculture.

Plate 141.

THE ROAD THROUGH THE RAIN FOREST.

A scene on the way from Mount Ossa to Kungurri, Queensland.

Silage.

A. E. GIBSON, Director of Agriculture.

SILAGE is the term given to green forage that has been preserved in such a way that it retains its succulence, palatability and, to a certain extent, its digestibility over an extended period.

Success in silage making depends chiefly on the exclusion of air from the material, which, in its processing, undergoes fermentation to a greater or lesser degree, during which the carbohydrates—such as sugars and starches—undergo certain changes and are reduced in value. Similarly, the proteins are reduced and acids—such as lactic and acetic—are formed; while, in the case of inferior silage, butyric acid is present. The exclusion of air from silage has the effect of reducing fermentation. In order to facilitate fermentation, weighting material is used, either by mechanical means or of stone, concrete blocks, heavy wood, or soil. The last mentioned is, however, the least satisfactory of all as a weighting material, for it becomes more or less mixed with the silage.

Although it is possible to utilise a variety of green materials for silage, naturally the best results are obtained by using the best class of fodders. Lucerne, which, without doubt, is the best class of material for hay making, does not lend itself to processing as silage; although it may be utilised to advantage, if combined with fodders such as maize or sorghum, when these two materials have reached a more mature stage than that considered necessary for the production of a good class of silage. Legumes, generally speaking, cannot be recommended for use for silage, unless mixed with some other material having a higher percentage of fibre in its composition.

The most suitable summer crops for silage purposes are in order of preference: Maize, sorghums, millets, setaria species (panicums). The winter cereals—preferably a combination of barley, oats, and wheat, with a mixture of peas or vetches, sown in equal quantities at the rate of 60 lb. per acre of the mixture—form a valuable silage material. In harvesting, however, they require to be handled with a reaper and binder in preference to a mower.

The stage of maturity at which a crop is harvested for ensiling has a distinct bearing also on the quality of silage produced. Maize harvested when the cobs have just reached the glazed stage, but, in which the grain still contains more or less milky substance, produces material having that pleasant acid smell which is associated with good silage and is light brown or yellow-brown in colour. Fermentation occurs usually when the temperature of the material is between 104 and 112 degrees Fahr. Sorghums, when harvested at the period at which the seed has been formed and is in the dough stage, produce good quality silage; but, owing to their high saccharine content, fermentation is more pronounced and a higher temperature is reached than in the case of those crops in which the sugar content is lower. Sorghum silage is dark brown to black in colour according to the temperature above 115 degrees Fahr. at which fermentation usually takes place.

Silage produced from crops having an excess of moisture, due to immaturity at harvesting, has an unpleasant odour on account of the presence of butyric acid and is not relished by live stock. Musty and

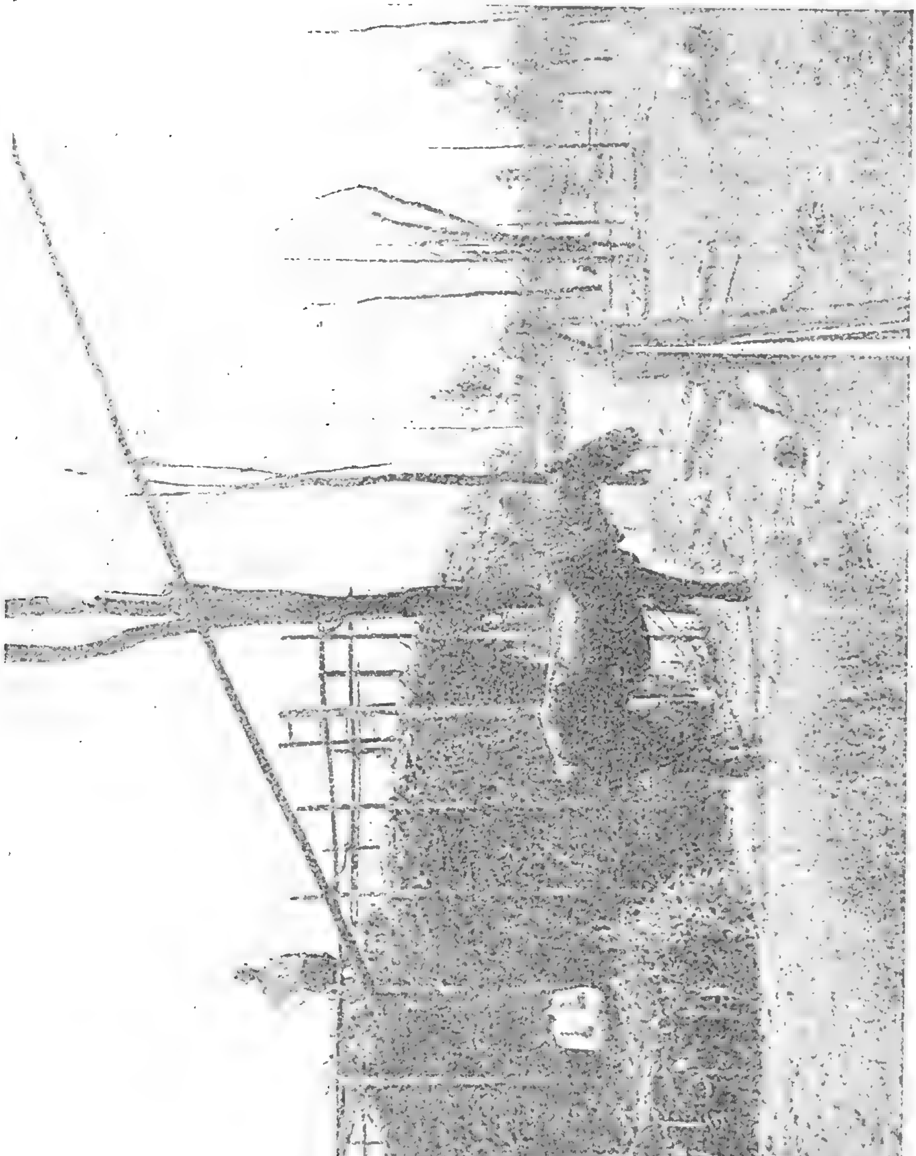


Plate 142.
Stack in course of construction, showing projecting "untrimmed ends," also "whip" hoist attached by means of a chain to a dead tree.

Plate 143.
Building a Silage Stack on a Lockyer Farm.

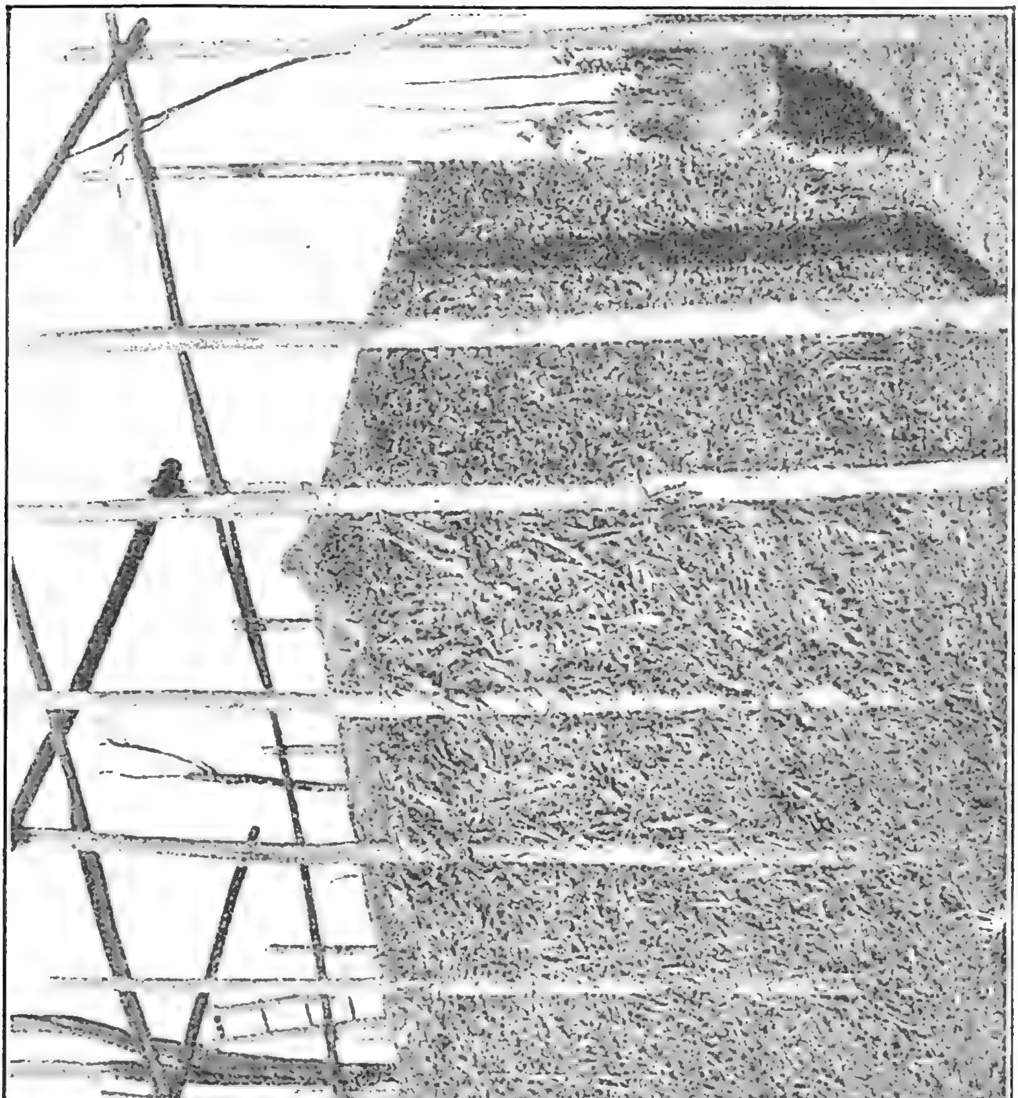


Plate 144.

Framework and "trimmed" stack, showing an extra pair of uprights at each end, to which a crosspiece is attached for supporting the ends of the fodder when stacking.

mouldy silage, on the other hand, is caused by the ensiling of material which is too dry for the purpose. It is sometimes noticeable in silos where neglect to remove dried-out material during a cessation in filling operations, or where air has had access to silage in the vicinity of doors which are not airtight.

During periods of drought the demand for information on silage in all its phases encourages the hope that an increased production of fodder crops for conservation in that form will follow the return to normal conditions. Unfortunately, however, a spirit of optimism based on a belief in a continuity of good seasons often persists, and, consequently the necessity for providing for lean years is relegated to the limbo of things forgotten.

Arguments in favour of hay in preference to silage are frequently advanced, but when farmers consider that hay loses at least 75 per cent. of its weight in the stack whilst silage loses no more than 15 per cent.

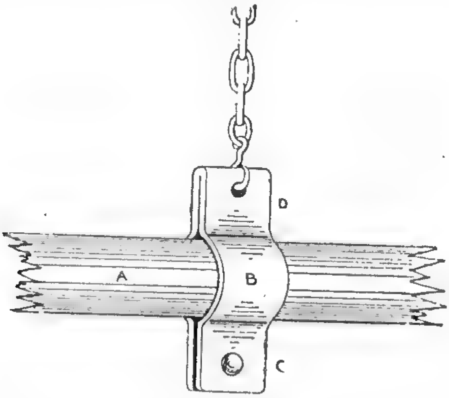


Plate 145.

Clamp for Suspending Whip.—(*a*) Whip spar. (*b*) Clamp made from an old tyre 4″ × ⅝″. (*c*) Clamping bolt. (*d*) Clamp welded and bored for hook.

the case for hay is considerably weakened. Again, lucerne—the most popular fodder used for hay—is of much higher monetary value during periods of drought than wheat or oaten hay, due, of course, to its higher nutritional value. When used as fodder for dairy cattle during periods of drought, however, the economic value of lucerne compared with silage on a tonnage basis is distinctly in favour of silage, consequently the dairy farmer who can conserve fodder in the form of maize silage at a cost of 12s. a ton, with a loss of only 15 per cent., is in a much better position than the man who conserves lucerne at a value of, say, £5 a ton, and loses 75 per cent. of weight of green material in so doing.

That both summer and winter growing fodders can readily be conserved in the form of stack silage is generally conceded, and provided that care and attention is given in regard to stacking and covering sufficiently from weather influences, no reason exists why the resultant silage should not keep good for at least two or three years without any serious depreciation. The literature issued by the Department entitled "Some Notes on Silage," "Silos and Silage," is available to those who contemplate ensiling operations, and a careful perusal is advised.

Enquiries which reach the Department relative to type of silo deal invariably with the underground type in preference to the overhead type. It is somewhat difficult to understand why the ideas of

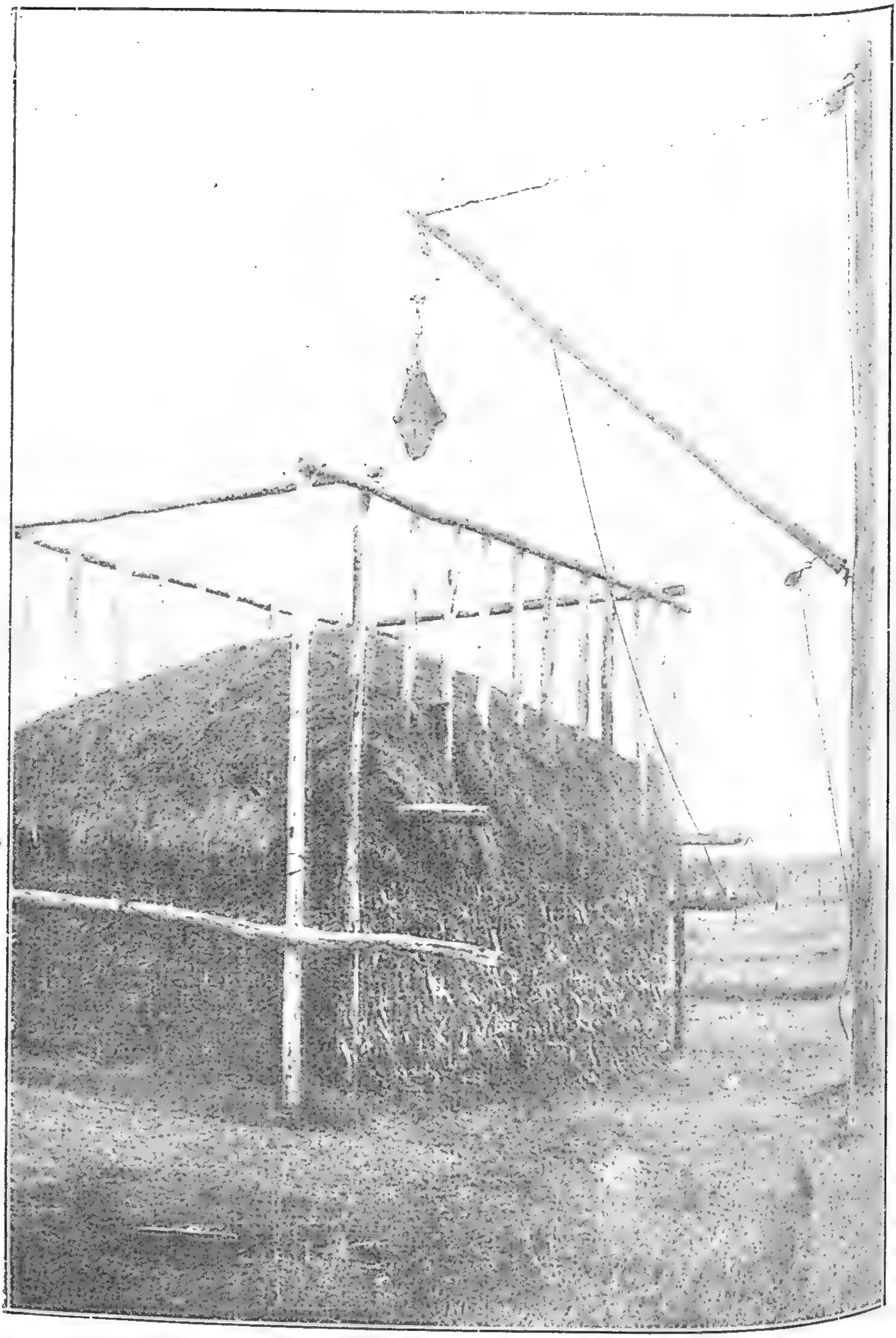


Plate 146.
A Silage Stack on a Central Burnett Farm.

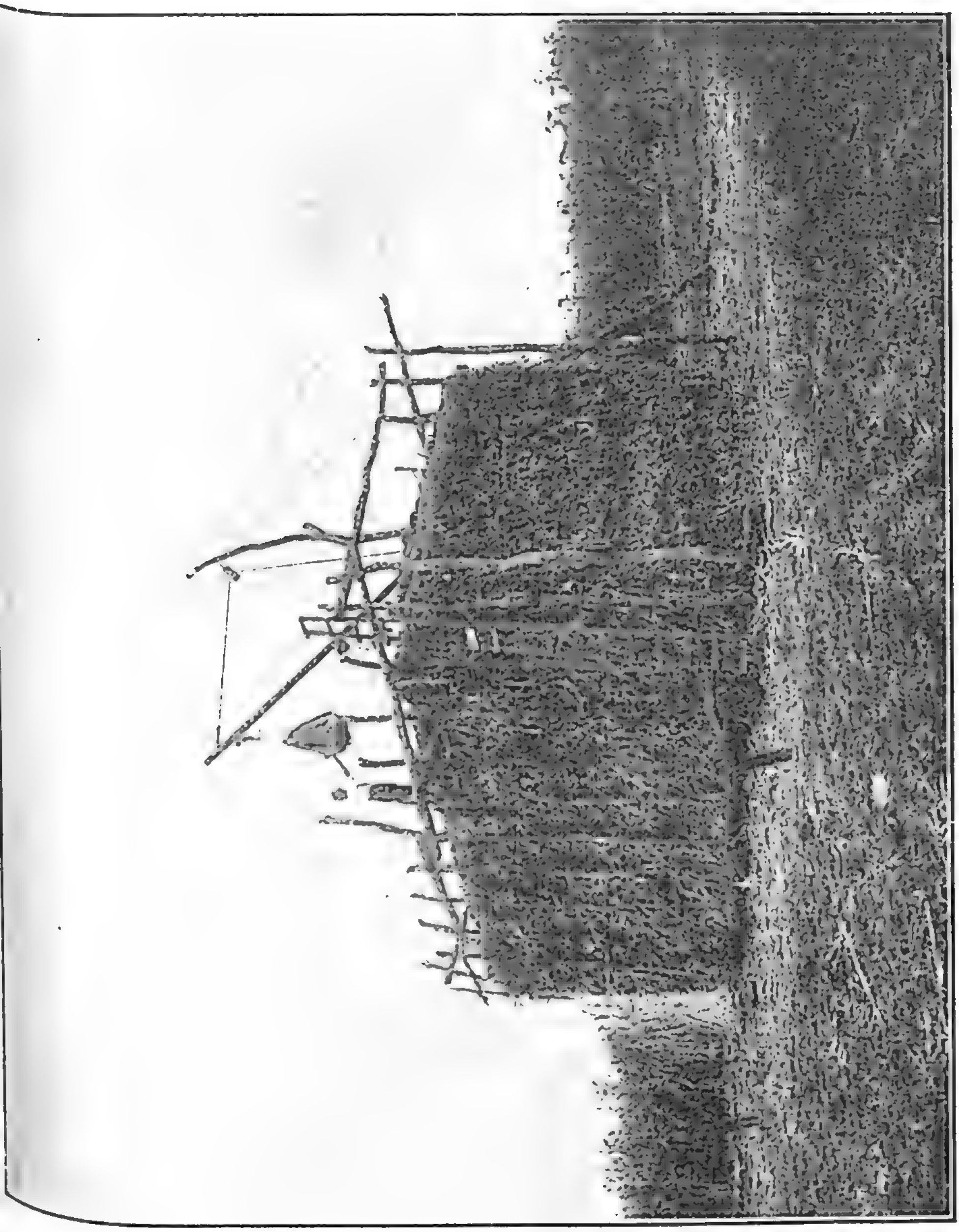


Plate 147.

Stack on the Darling Downs nearing completion. Weighting material (stones) being hoisted by a horse prior to the topping off of the stack with bush hay.

those who are inclined towards silage conservation should run in the direction of pits instead of overhead structures. It would appear that the ease with which the underground silo can be filled quite overshadows the difficulty of emptying it. To those who are lacking in silage experience, it is suggested that the stack method should be adopted and later on, when they have experienced the benefits that accrue from the use of silage as a fodder, that earnest consideration be given to the erection of a silo of a suitable type.

When it is considered that no technical difficulties surround the conservation of fodder in the form of ensilage the question is asked: Why do stockowners as a rule sidetrack silage making? As maize or sorghums are usually the crops chosen, it has been suggested that the work of handling what is naturally weighty material is regarded as somewhat laborious, apart from which a good deal of hand work is entailed. The correctness of this is admitted, but, at the same time, the opinion is expressed that if similar methods of harvesting maize and sorghums for silage were utilised in the case of such crops as oats, wheat, or barley, little if any of the latter crops would be grown. In these days of improved methods retrogression in harvesting practices is not economically sound, yet many of our potential fodder conservationists give no consideration to this aspect of the question, while holding very definite opinions on the merits of the various types of silos. Might it be suggested that if greater consideration were given to labour-saving methods and machinery silage conservation would be practised more widely than it is at present? For example, consideration might be given to:—

(*a*) The use of maize harvesting machinery;

(*b*) Utilisation of tabletop lorries, mounted on motor-car types of wheels;

(*c*) The building annually of silage stacks.

With regard to (*a*) it is suggested that neighbourly co-operation would reduce the individual cost of the maize harvester, which is obtainable in Queensland at £84.

(*b*). Loading green maize on drays or waggons of the ordinary type wastes a considerable amount of human energy, whereas the handling on to low table-topped waggons is comparatively easy. Sets of motor wheels are procurable from most dealers, and are readily adaptable for purposes of farm transport, while they have the further advantage of considerably reducing draft.

(*c*). That silage stacks are recommended does not necessarily mean that silos are looked on with disfavour, but emphasis is certainly placed on the necessity of possessing harvesting or transporting machinery and utilising the stack method in preference to having an expensive silo and only crude or laborious methods of filling it. The advantages (monetary and otherwise) that will accrue from the former will ultimately be a guide and of assistance when it is found necessary to adopt the silo in preference to the stack method—with the added possibility that it may not be necessary to go beyond one's current banking account in order to finance such a project.

Composition of Some Fruits and Fruit Waste.

E. H. GURNEY, A.A.C.I., Agricultural Chemist.

AS requests have frequently been forwarded to the Department for information concerning the composition of fruits and fruit waste, analysis of some fruits appearing on the market have been made, and these analyses are given in attached tables.

According to nature of season it is possible that some variation in composition of the different fruits may occur, and for this reason further analyses will be undertaken of fruits in season and also analyses of fruits not listed.

In connection with the attached tables of analyses, it must be understood that the first column refers only to the weight of sample submitted for analysis, and not to the average weight of fruit that may have been upon the market throughout the season.

The samples which were analysed were fruits already on the market, and hence all were available for public purchase. Some of the fruits had not reached the full stage of ripeness and, therefore, a rather higher acidity may be shown than would be the case with fully matured fruits.

It may be observed that the sucrose content (cane sugar) of some fruits is much lower than in others.

Fruits are valuable as an item in the diet on account of the presence of sugars which are easily digested. Fruit flavours are also stimulants to the appetite, while fruits contain some of the vitamins necessary for good health.

Analyses of the Edible Portion of Some Queensland-grown Fruits.

Fruit and Variety.	Average Weight in Grammes.	Edible Portion. (Per Cent.)	Skins. (Per Cent.)	Seeds. (Per Cent.)	Moisture. (Per Cent.)	Ash. (Per Cent.)	Protein. (Per Cent.) (N x 6·25.)	Per Cent. Sugars. Reducing Sugars as Glucose. (Per Cent.)	Per Cent. Sugars. Sucrose. (Per Cent.)	Refractive Index of Juice at 28° C.	Total Solids in Juice by Refractive Index. (Per Cent.)	*Fibre by Sugar-cane Method. (Per Cent.)	Acidity, 100 Grammes of Fruit contain the Equivalent of Grammes H_2SO_4.	pH.	Remarks.
Plums, var. Wilson ..	17·9	91·5	..	8·5	86·4	0·44	0·36	3·61	3·96	1·3500	11·93	0·70	0·92	3·65	Not quite ripe. Flesh hard. Fairly sweet. Slightly tart at seed.
Pawpaw	868·0	74·3	12·0	13·7	89·7	0·50	0·53	7·26	Nil	1·3460	9·38	0·91	0·07	5·63	One large and one small fruit. Both about half coloured.
Cherries (Black), var. ..	7·58	93·07	..	6·93	73·4	0·71	2·09	13·23	0·13	1·3619	19·50	4·3	0·45	4·03	..
Cherries (White) var. ..	4·94	91·08	..	8·92	83·5	0·61	0·96	10·45	0·48	1·3530	14·00	3·2	0·74	3·77	..
Peaches	110·6	91·4	..	8·6	87·6	0·55	0·84	1·91	5·78	1·3478	10·58	1·74	0·61	3·73	..
Apricots	48·8	91·8	..	8·2	87·2	0·66	0·83	1·56	5·73	1·3489	11·33	1·38	0·84	4·60	..
Plums, var. Burbank ..	67·2	95·53	..	4·47	89·4	0·42	0·56	2·22	6·32	1·3496	11·75	1·37	1·11	3·41	Some soft, with a sweet insipid taste. Some firm. Tart taste.
Plums, var. Black Diamond	55·7	92·57	..	7·43	87·0	0·47	0·45	4·08	4·76	1·3526	13·70	1·91	0·94	3·04	A few soft, with a slightly tart taste. Others firm; very tart taste.
Bananas, var. Sugar ..	60·5	73·2	26·8	..	69·4	1·10	1·43	18·45	2·99	..	..	4·45	0·47	4·57	..
Bananas, var. Cavendish	142·5	66·2	33·8	..	72·8	0·99	1·16	10·46	8·17	..	..	2·30	0·20	4·71	..
Bananas, var. Ladies' Finger	96·3	70·0	30·0	..	64·3	0·87	0·98	19·10	2·26	..	..	8·90	0·34	4·54	..
Passion Fruit	29·2	54·8	45·2	10·5	71·1	0·70	2·39	5·14	4·18	1·3567	16·30	14·16	2·13	3·26	Edible portion includes seeds.
Figs	27·1	85·4	14·6	..	82·3	0·37	0·71	13·92	0·35	1·3570	16·50	1·33	0·15	4·80	Edible portion includes seeds.
Persimmons	142·0	100·0	..	..	83·7	0·34	0·29	10·98	..	1·3530	14·02	..	0·07	6·80	Analysis of whole fruit; seedless.
Mango	259·8	63·7	20·1	16·2	87·39	0·35	0·36	4·93	4·22	1·3491	11·46	1·04	0·09	4·53	..
Pears, var. Parker's Triumph	156·8	96·12	Skins & Seeds = 3·88		83·4	0·31	0·30	8·57	0·35	..	..	3·09	0·06	4·78	On the market, but immature.
Pears, var. Rome Beauty	164·7	92·60	Skins & Seeds = 7·40		83·7	0·35	0·36	7·62	3·38	..	..	3·19	0·42	3·32	On the market, but immature.
Pears, var. William ..	112·7	94·7	Skins & Seeds = 5·3		81·9	0·28	0·32	8·38	0·70	..	..	3·67	0·06	4·95	On the market, but immature.
Apples, var. Delicious ..	122·0	92·9	Skins & Seeds = 7·1		81·2	0·28	0·19	10·68	2·06	..	..	3·09	0·13	4·05	On the market, but immature.
Egg Fruit	532	92·3	7·7	Trace	93·7	0·40	0·71	2·68	0·09	1·3379	3·98	2·5	0·06	4·90	..
Jack Fruit	8 lb.	53·9	29·8	5·1	67·1	3·40	2·0	17·38	2·27	..	..	4·05	0·46	5·0	Inedible centre 11·2 per cent.

* The method of determining fibre is the standard method adopted in Queensland sugar mills.

Analyses of Seeds, Skins, &c., of Some Queensland-grown Fruits.

Sample.	Whole Fruit. (Per Cent.)	Whole Seed. (Per Cent.)	Moisture. (Per Cent.)	Ash. (Per Cent.)	Protein. (Per Cent.)	Fat. (Per Cent.)	Fibre by Acid-alkali Method. (Per Cent.)	Carbo-hydrates. (Per Cent.)	Sugars. Reducing Sugars as Glucose. (Per Cent.)	Sugars. Sucrose. (Per Cent.)	Lime CaO. (Per Cent.)	Phosphoric Acid. P_2O_5. (Per Cent.)	Potash. (Per cent.)	Hydrocyanic Acid.	Remarks.
Wilson Plum Seed Shells	7·0	82·4	17·7	0·94	..	..	57·4	..	..	..	0·07	0·02	0·05	..	..
Wilson Plum Seed Kernels	1·5	17·6	20·0	1·71	19·49	28·76	10·2	19·84	..	..	0·256	0·67	0·31	+	..
Cherry Seed Shells ..	7·17	90·0	10·7	2·0	2·1	..	59·3	..	..	..	0·56	0·216	..	..	..
Cherry Seed Kernels ..	0·80	10·0	13·1	4·5	28·6	22·5	..	..	..	..	0·064	1·306	..	..	..
Peach Seed Shells ..	} 8·6 {	..	10·4	1·6	1·2	..	62·5	..	..	..	0·28	0·161	..	..	..
Peach Seed Kernels ..		..	11·0	5·5	24·1	42·4	..	..	..	..	0·18	1·074	..	+	..
Apricot Seed Shells ..	6·15	75·0	11·4	1·68	1·1	..	49·0	..	..	..	0·49	0·183	..	..	..
Apricot Seed Kernels ..	2·05	25·0	7·6	3·6	25·6	75·8	..	..	..	..	0·14	1·410	..	+	..
Sugar Banana Skins ..	26·8	..	85·4	2·6	2·6	0·7	1·9	6·8	6·14	Nil	0·017	0·158	..	..	..
Ladies' Finger Banana Skins	30·0	..	87·7	2·0	0·9	0·9	1·9	6·6	5·51	0·26	0·082	0·111	..	..	..
Cavendish Banana Skins	33·8	..	90·0	2·6	1·1	0·4	1·5	4·4	3·33	0·66	0·027	0·072	..	..	..
Passion Fruit Skins ..	45·2	..	81·7	1·9	1·9	0·2	7·3	7·0	..	..	0·060	0·032	..	..	..
Passion Fruit Seeds ..	10·5	..	..	..	8·49	..	..	..	Nil	..	..	..	..	..	..
Fig Skins	14·6	..	76·3	0·7	1·5	0·5	2·3	18·7	..	..	0·162	0·055	0·233	..	..
Mango Skins	20·1	..	79·3	0·60	0·90	0·3	3·1	15·8	..	..	0·085	0·044	0·393	..	..
Mango Seeds Outside Husk	8·12	50·1	6·46	2·1	0·3	0·5	50·3	38·3	..	..	0·246	0·111	0·724	..	..
Mango Seeds, Parchment-like Covering of Kernel	0·32	2·0	6·73	1·8	20·2	..	50·25	..	..	..	0·337	0·123	0·402	..	..
Mango Seed Kernel ..	7·76	47·9	8·0	3·1	6·0	7·8	5·6	69·5	..	..	0·224	0·421	..	..	..
Jack Fruit Skin	29·8	..	60·1	2·83	2·79	1·87	7·58	24·86	..	..	0·17	0·13	..	..	..
Jack Fruit, Centre ..	11·2	..	80·8	3·27	1·75	0·58	3·33	10·29	..	..	0·090	0·105	..	..	..
Jack Fruit, Seeds.. ..	5·1	..	48·8	1·59	6·04	0·05	4·40	39·12	..	..	0·085	0·275	..	..	..

Granadilla Packing.

JAS. H. GREGORY, Instructor in Fruit Packing.

THE granadilla, like most tropical fruits, is of a soft nature when ripe, and it is therefore necessary to exercise great care in the harvesting and packing of this fruit. Owing to the large size of the fruits, the loss of even one in a packed case would be considerable. Maturity and size have to be taken into account to ensure successful marketing.

Maturity.

It can be safely said that the greatest fault found on the inspection of granadillas at the markets is that of immaturity. Most growers appear to be afraid to permit the fruit to mature on the vines, yet the writer procured fully matured, coloured, but firm, specimens of the fruit in Cairns during a warm period in the month of May and carried them in a handbag to Townsville, where they ripened perfectly, and were consumed ten days later. Experimental consignments packed on the lines indicated in this booklet travelled from Cairns to Brisbane, and kept in sound condition for fourteen to twenty days, and then ripened satisfactorily.

When matured the fruit loses its white, and with some varieties its green, appearance, taking on a golden green colour at the end, and this is the correct stage at which to remove the fruit from the vine for long-distance transport. For local marketing the golden colour should be allowed to cover the whole of the fruit before it is removed from the vine. Where there is danger of fruit fly attacks, the fruits can be protected until fully mature by placing paper bags over them.

Harvesting.

All fruit should be clipped to remove it from the vine, and should be gently placed in baskets or picking-boxes for removal to the packing-shed. Only a short length of stalk should be left attached to each fruit.

Packing-shed Equipment.

It is advisable to provide a flat-topped table on which to spread out the fruit to cool; the table should have a raised edge to prevent any fruits from rolling off. Covering the top of the table with a thin padding of bagging or similar material is advantageous in obviating many skin abrasions.

Whilst handling the fruit on to the table it can be sized into various sizes suitable for the different packs.

Containers.

The tropical fruit case, 24¾ inches long by 12 inches wide, by 12 inches deep is a suitable container. Of the bushel cases tried, the standard case, 18 inches long by 11½ inches wide, by 10½ inches deep, has been found to be by far the most suitable type of this size of container, and is strongly recommended for general use.

Packing Materials.

Woodwool is recommended as the most suitable material for padding purposes. Grass is unsatisfactory owing to its tendency to develop damp and heat in transit. This causes premature ripening of fruit. White or coloured plain paper for wrapping the fruits, and corrugated cardboard for lining the boxes and giving added protection to the fruit, are also necessary.

Packing.

Protection is the keynote of successful granadilla packing. The cases are first prepared by placing corrugated cardboard sheets on the bottom and sides, with the corrugated side to the wood, and a layer of woodwool is placed on the bottom. Each fruit is then rolled in plain paper and placed upon the woodwool until a complete layer is formed. The layer of fruit is then covered with woodwool, which is also placed in the crevices between the fruits. Another layer of wrapped fruit is then placed in the case, and alternate layers of woodwool and fruit until the case is filled. A study of the packing table will give the number of layers required to fill the case.

When packing the fruit care should be taken to always place the stalk end of the fruit to the wood of the box in order to give maximum protection to the flower end of the fruit, which softens first.

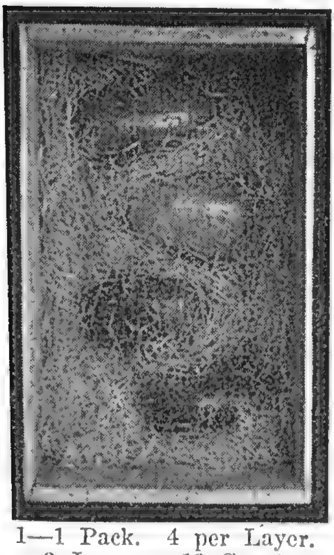
It will be noticed that there are two different types of packs, across the case, and from end to end. See Plate 149 and compare with other packs.

STANDARD BUSHEL CASE.

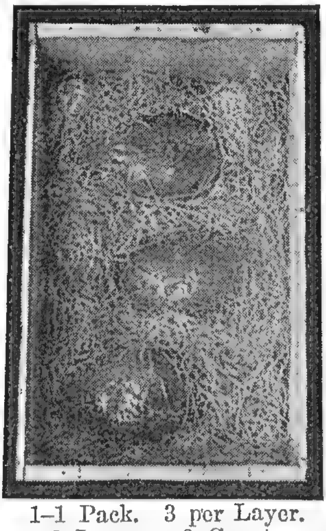
18 inches long x 11½ inches wide x 10½ inches deep.

First Layers.

Packed Across.



1—1 Pack. 4 per Layer.
3 Layers. 12 Count.



1–1 Pack. 3 per Layer.
3 Layers. 9 Count.
Note spacing of fruit.

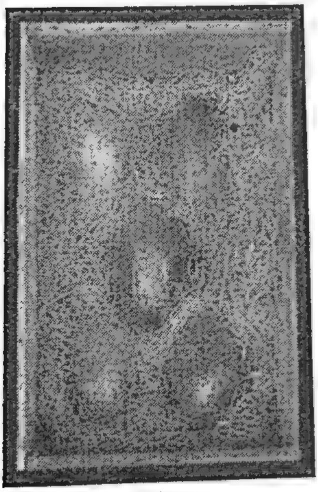
Note how to space fruit slightly apart to permit the layers to fit into each other and come to the correct height in the case. Pad well between each fruit.

Plate 148.

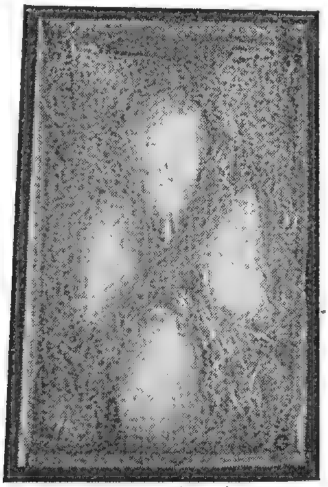
STANDARD BUSHEL CASE.

18 inches long x $11\frac{1}{2}$ inches wide x $10\frac{1}{2}$ inches deep.

Packed endways.



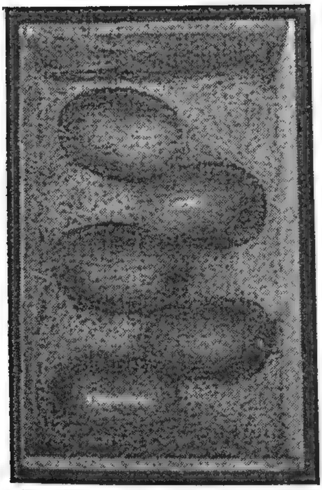
First and Third Layers.
Fruit Unwrapped to show method of placing.



Second and Top Layers.
Fruit Wrapped for Market.

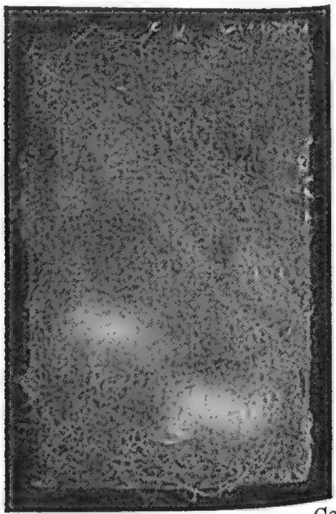
4 Layers to Case. 2 Layers of 5. 2 Layers of 4. 18 Count.

Plate 149.



1–1 Pack. 5 per Layer.
3 Layers. 15 Count.

Finishing Packing the Standard Case.



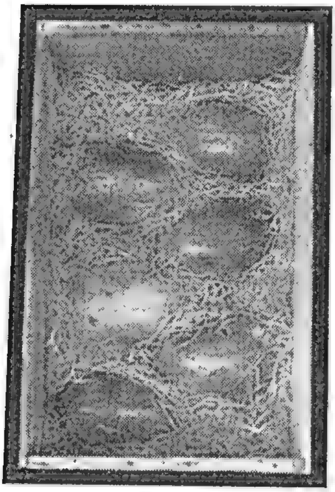
Showing a finished case. Completed by placing a layer of woodwool on the top. In this case the woodwool is removed to show method of wrapping fruit.

Plate 150.

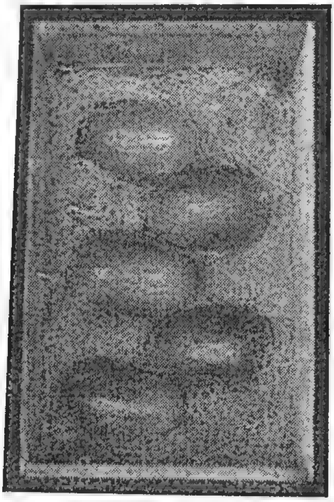
STANDARD BUSHEL CASE.

18 in. long by $11\frac{1}{2}$ in. wide x $10\frac{1}{2}$ in. deep.

First Layer Packed Across.



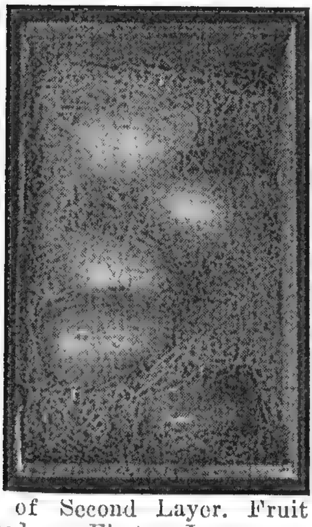
6 per Layer. 4 Layers.
24 Count.



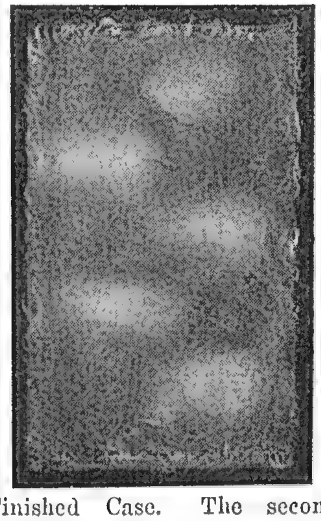
First and Third Layers.
5 per Layer. 4 Layers. 20 Count.

Plate 151.

Packed Across the Case.



Start of Second Layer. Fruit Unwrapped. First Layer. Fruit Wrapped.



Finished Case. The second layer is placed the same way as the top layer.

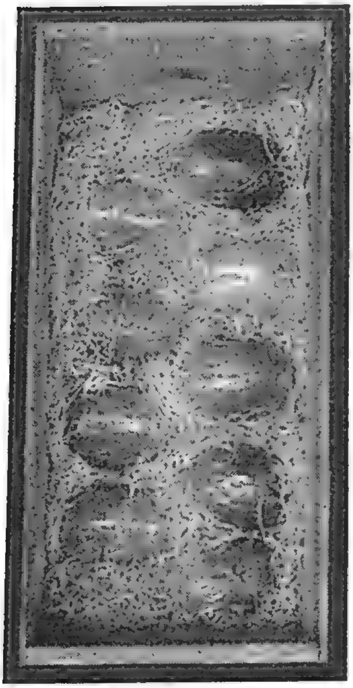
1–1 Pack. 5 per Layer. 4 Layers. 20 Count.

Plate 152.

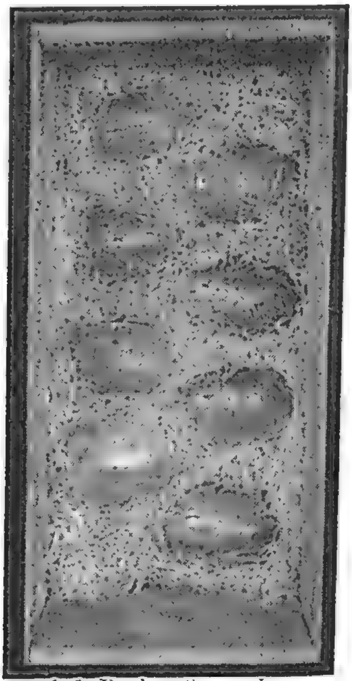
THE TROPICAL FRUIT CASE.

$24\frac{3}{4}$ inches long x 12 inches wide x 12 inches deep.

1–1 Pack Across.

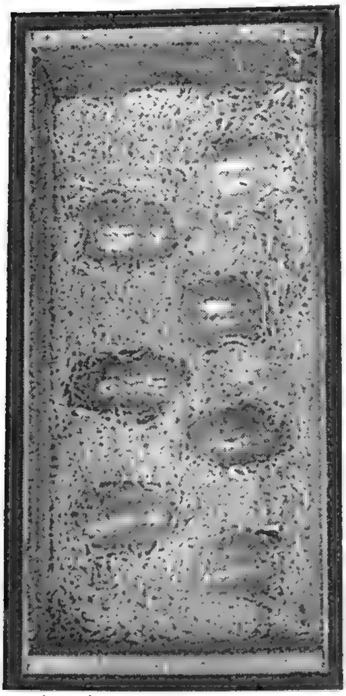


1–1 Pack. 9 per Layer.
4 Layers. 36 Count.



1–1 Pack. 8 per Layer.
4 Layers. 32 Count.

Plate 153.



1–1 Pack. 7 per Layer.
4 Layers. 28 Count.

1–1 Pack. 6 per Layer.
4 Layers. 24 Count.
The first row of the 21 pack is placed the same as this, but the fruit is larger.

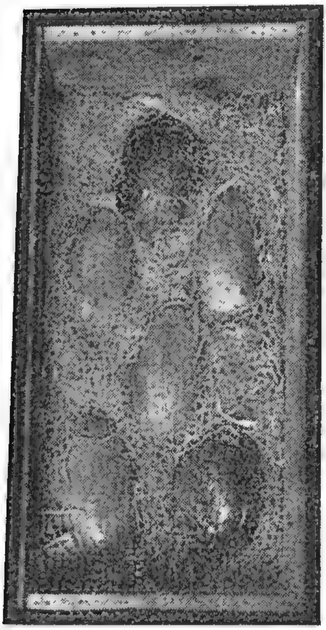
NOTE.—In counts 28 and 24 the fruit is spaced to permit the other layers to fit down better and so prevent the fruit coming too high in the case.

Plate 154.

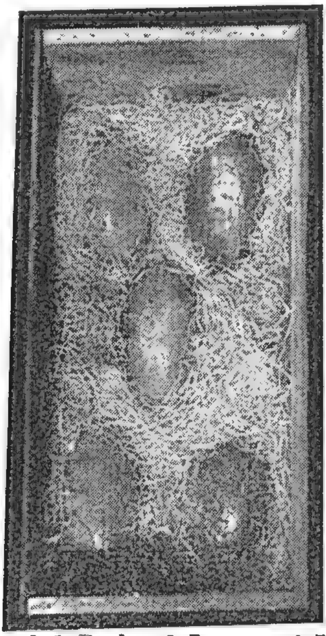
THE TROPICAL FRUIT CASE.

$24\frac{3}{4}$ inches long x 12 inches wide x 12 inches deep.

2—1 Pack. Endways.



2–1 Pack. 6 per Layer.
3 Layers. 18 Count.



2–1 Pack. 2 Layers of 5.
1 Layer of 4. 14 Count.

Plate 155.

GRANADILLA PACKS.

Tropical Case—$24\frac{3}{4}$ in. long x 12 in. wide x 12 in. deep.

Approximate Average Size (Diameter).	Pack.	No. in each Layer.	No. of Layers.	Total.	Remarks.
$3\frac{7}{8}$ inches ..	1—1	9	4	36	Pack Across
4 ,, ..	1—1	8	4	32	Pack Across
$4\frac{1}{4}$,, ..	1—1	7	4	28	Pack Across
$4\frac{1}{2}$,, ..	1—1	6	4	24	Pack Across
5 ,, ..	1—1	7	3	21	Pack Across
$5\frac{1}{4}$,, ..	2—1	6	3	18	Pack Endways
$5\frac{1}{2}$,, ..	2—1	2 layers of 5 1 layer of 4	3	14	Pack Endways

Standard Case—18 in. long x $11\frac{1}{2}$ in. wide x $10\frac{1}{2}$ in. deep.

Approximate Average Size (Diameter).	Pack.	No. in each Layer.	No. of Layers.	Total.	Remarks.
$3\frac{7}{8}$ inches ..	1—1	6	4	24	Pack Across
4 ,, ..	1—1	5	4	20	Pack Across
$4\frac{1}{4}$,, ..	2—1	2 layers of 5 2 layers of 4	4	18	Pack Endways
$4\frac{1}{2}$,, ..	1—1	5	3	15	Pack Across
	1—1	4	3	12	Pack Across
	1—1	3	3	9	Pack Across

Acknowledgment.—Thanks are due to all growers and fellow officers who assisted in making available fruit and facilities for packing and photographing.

Passion Fruit Growing on the South Coast.

J. McG. WILLS, Fruit Branch.

[*Continued from page 332, March, 1937.*]

PREPARATION OF THE LAND.

THE thorough preparation of the land in which passion fruit vines are to be planted is essential in order that the young plants may establish themselves rapidly and develop a root system that can traverse a greater area from which to draw available plant food. No after cultivation will produce equal results. Wherever ploughing is possible the land should be ploughed deeply and worked into a fine tilth.

On land where ploughing is not possible the soil should be broken up by hand, mattocks or steel pronged forks being used for this purpose. On forest land, where hardwood stumps do not rot quickly and cost of stumping is very high—also on slopes too steep for the use of horse-drawn implements—the preparation and subsequent cultivation must all be done by hand.

Unburnt logs placed across the slope of the land will to some extent prevent surface soil erosion. Where the surface is stony time expended in placing the stones in lines at regular intervals across the slope will be regained many times in subsequent chippings. The preparation should help in the retention of surface soil and be completed by the end of August, as the land will then be in a condition to absorb any rain that falls. Planting out the young seedlings can be commenced in spring time with every prospect of them becoming quickly established in their new location.

As our coastal soils are acknowledged to be deficient in lime an application of lime at the rate of from ½ ton to 1 ton per acre would be an advantage. The lime will assist in correcting any acidity in the soil, hasten the decay of organic matter, render plant food more readily available, and improve the general physical condition of the soil.

Trellising and Planting Distance.

Growers' opinions differ on the question of the most suitable distance at which the vines should be planted. On the South Coast the most favoured distance is 10 feet between rows and 16 feet between each plant, giving roughly 270 plants to the acre. These distances permit the natural vigorous expansion of the vines along the trellis, while there is sufficient room between the rows to work horse-drawn implements without damaging the trellises, even when wide spreaders are used on the horizontal type of trellis. At the same time a better coverage is obtained, leaving little, if any, land exposed to the harmful effect of the sun's direct rays.

Planting too close in the rows is of little or no advantage, for, after the first year, the foliage of the vines will become too dense, thus necessitating the cutting out of possibly half the number of vines planted. This action is necessary to keep the foliage sufficiently open to admit light and allow for the free circulation of air throughout the vine, and also to permit dead fungus affected leaves to fall clear to the ground, carrying with them the spores which would otherwise infest other growing portions of the plant.

For the proper development and ripening of the fruit sunshine and air should penetrate to all aerial parts of the vine, hence the necessity, wherever possible, for running the trellises in a north-south direction. The vines will then have an even distribution of sunlight over the whole of the growth on the trellis.

If the vineyard is established on a steep hillside it may be inconvenient to plant north and south. However, where possible, this direction should be the rule.

If the vineyard be laid out across a slope then added provision can be made to conserve the surface soil by laying logs or stones also across the slope. The construction of contour drains to carry off excess surface water during heavy rainfall would be a decided advantage.

Plate 156.

A 10-months' old passion fruit vineyard on red-oak soil at Mudgeeraba.

The cost of wire, posts, and strainers and their erection are initial items of expenditure which influence to a great extent the choice of trellis to be erected. In commercial vineyards the trellises are mainly one of two types—either the vertical or the horizontal trellis. Both types have advantages and disadvantages, hence the main deciding factor is usually one of cost. A vertical trellis is less costly than a horizontal trellis, therefore, if posts and strainers have to be purchased growers mostly erect a vertical trellis at first; any extension of the area can be trained on a horizontal trellis if so desired when capital is available. Wherever the grower is capable of splitting and erecting the posts and strainers from suitable timber in the vicinity of the vineyard a considerable saving will be made. Usually there is plenty of suitable timber growing handy. Most of the natural hardwoods will last longer than the passion vines, which are comparatively short lived.

If selection is possible, then posts split from bloodwood, ironbark, grey gum, or yellow stringy will prove to be satisfactory in every way, for the varieties of timber named will last in the ground for many years and will serve as posts for successive sets of trellis.

The trellis should be inexpensive, although substantial enough to support a heavy growth of vines and fruit. The type of trellis erected, together with pruning and training of the vine, have an important influence in the control of fungus diseases. The idea to keep in mind should be the production of a sufficiency of surface foliage to carry a heavy crop while maintaining an open habit of growth.

The grower, therefore, may choose (1) a vertical trellis or (2) a horizontal trellis, and the height of the top wire in each case should not be less than 6 feet clear above the ground.

In a horizontal trellis the two wires are run side by side while in a vertical trellis the wires are run one above the other as in an ordinary fence. The posts for the trellis should be 7 feet 6 inches long, 7 inches

Plate 157.
Vine 10 months old. Note sturdy growth of twin leaders, dense vigorous laterals, and advanced fruit.

wide, and not less than 4 inches thick, set 16 feet apart and 18 inches in the ground, with 10 feet between rows. The strainers should be of much heavier material, and may be either round or split. They should be set 2 feet 6 inches in the ground, and must be well strutted or stayed so as to take the strain of the wires, the portion in the ground to be free of sapwood. One strainer to every 80 yards will prove sufficient in most locations. The posts should be erected with their width across the row.

For a vertical trellis holes are bored in the posts, through which the wire is run. One wire is run as close to the top of the post as practicable, and the second wire is run usually between 12 and 18 inches below, 15 inches being the average spacing between these wires.

The horizontal type of trellis is mostly favoured on the South Coast, and the distance between the wires has been recently increased to 24 inches, and this apparently has a decided advantage over the closer trellis in that it permits the entry of sunlight and air between the two sets of laterals, thus promoting the flowering and setting of fruit on the inner

growth of the vine. At the same time this practice should assist materially in maintaining a more open growth, allowing dead and diseased leaves to fall clear to the ground, carrying with them any fungus spores adhering to their surfaces.

In order to keep the wires apart in a horizontal trellis a T-piece not less than 2 inches by 2 inches, cut to the length desired, is fastened to to top of the post and the wires run through holes bored in the ends of the T-pieces and strained on the strainer posts.

It is an advantage to make some provision whereby the wires can be kept strained and so prevent heavily laden laterals from sagging to the ground. Small cast-iron rollers can be procured cheaply and are excellent for this purpose, being easily operated and always in position.

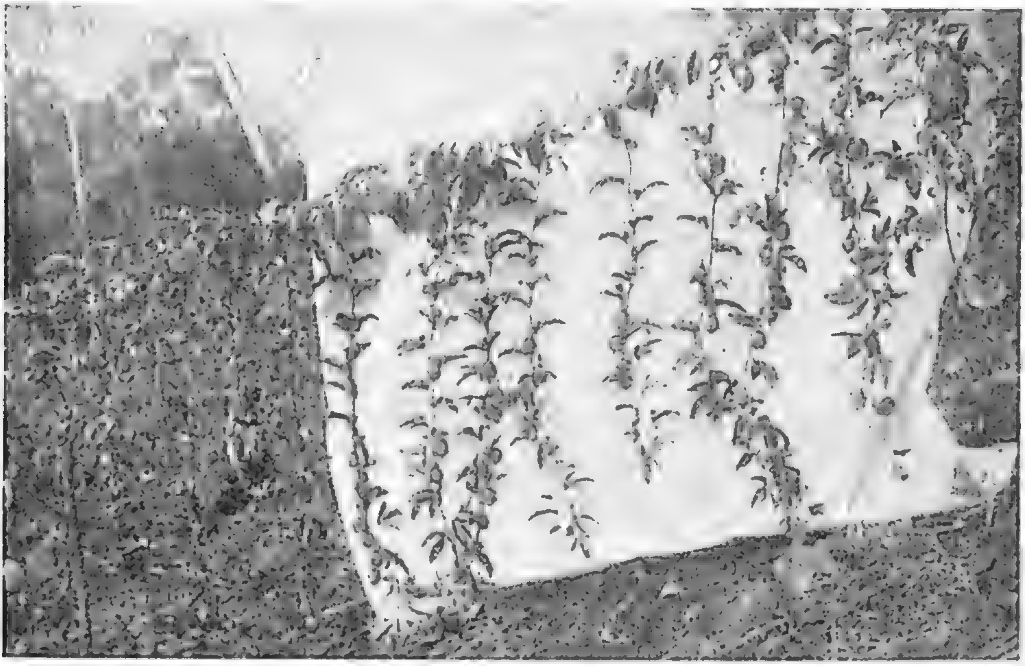


Plate 158.
Laterals on young vine 10 months old, showing open spacing, vigorous growth and cropping habit.

Various gauges of wire are used. Some growers prefer No. 8 galvanised iron wire, while on some of the more recently erected trellises 10 x 12 gauge high tension steel wire has been used. This wire, although rather thin, is very strong and carries the weight satisfactorily; also there is less stretching and sagging between the posts than is the case with iron wire.

Black iron wire, although cheaper to buy, should not be used in the South Coast district as it soon rusts, stretches, and sags, necessitating propping up between the posts in order to keep the laterals and fruit clear of the ground.

Should the wires sag between the posts stakes may be placed temporarily in position to support the wire until the crop has been harvested, then, after pruning, when the weight on the trellis has been reduced, the wires may be restrained with little possibility of the wire snapping.

Beginners would be well advised to experiment with a few rows of each type of trellis, and by keeping a careful check on production, &c.,

the most satisfactory type in any particular locality can be readily ascertained; any extension of area can be laid down accordingly, while original trellises can be converted as occasion requires.

Propagation.

Passion fruit plants may be propagated either from seeds or cuttings, although the latter practice is rare.

Growers are recommended to raise their own plants, and for this purpose only fruits fully matured and selected from healthy vigorous heavy-cropping vines should be used.

Growers cannot be too careful in the selection of seed material, as the passion fruit is subject to several diseases, and the possibility of transmitting these diseases by seed cannot be ignored. The seed may be allowed to dry in the pulp, provided precautions are taken to prevent the growth of moulds on the fruit. Another method is to remove the pulp, place it in a vessel of water for a few days until it ferments, when the seeds will easily separate from the fruit pulp. The seeds should then be washed in clean water and placed in the shade to dry.

Should early spring-ripened fruits be selected and the seeds planted immediately, seedlings will be ready to plant out in early summer. A later sowing would provide seedlings suitable for autumn transplanting.

If early spring planting is desired—this being the season most preferred—then seedlings should be raised from fruits maturing in the late summer. Such seedlings should be well grown before winter and be available when seasonal conditions are suitable for transplanting with every prospect of the young vines rapidly establishing themselves in their new situation. The site of the seed-bed should be very carefully selected. It should not be in close proximity to any other passion vines, either cultivated or otherwise, owing to the possibility of introducing woodiness or other diseases into the nursery. The soil should be friable and contain an abundance of plant food. After the soil has been well worked into a fine state of tilth the seeds should be planted just below the ground surface, about half an inch down, the soil afterwards being firmly pressed and covered with half an inch of fine horse manure as a mulch. The seedlings should appear in from four to six weeks, and as they develop they may be thinned out to about 4 inches apart—those remaining will then develop into sturdy plants with good root development. Lanky, weak plants will result from any crowding in the seed-bed.

Some growers first erect the trellis and then plant several seeds at the required planting distance under the trellis, afterwards selecting the most vigorous of their young plants and removing the others. This practice is not recommended as germination is often poor, the young plants are exposed to infection from any diseased vines which may be in the vineyard, and, generally, they require extra attention until they become well established.

Transplanting.

When the seedlings have attained a growth of from 6 to 9 inches they are suitable for transplanting. Larger plants have a greater tendency to wilt, and do not become established as quickly as smaller plants. Transplanting may be done at any time of the year, but from September to February is considered to be the most suitable time. Transplanting during the months from March to August is not recommended,

except in very favourable locations, as the plants rarely establish themselves satisfactorily, and being more or less stunted do not respond rapidly to the following spring conditions.

Seedlings planted out between September and January should return a profitable crop in the following twelve to sixteen months, provided the seasonal conditions have been normal.

Select dull, cool, or moist weather for transplanting, as hot, sunny, or windy days injure the plants by increasing transpiration. Plant the vines under the trellis in holes which have been dug ready to receive the young plants. These holes should be large enough to allow for the natural spreading of the roots. Surface soil should be filled in around the roots and pressed down firmly. A good watering should be given each vine before the holes are filled in. If weather conditions are dry subsequent waterings and partial shading may be necessary until the plants have become well established.

Care should be taken to see that the vine is not planted deeper in the hole than it occupied in the nursery, otherwise if the crown of the plant is below the surface it may become attacked by a fungous base rot which may kill the vine.

Two or three weeks before transplanting cut back any excessive top growth the seedlings may have made, and sever the larger roots by pushing a spade down full depth along and between the rows of plants which may then be easily removed when required with a minimum of root disturbance. The seedlings will rapidly recover from the shock of transplanting. Dig only as many plants as can be transplanted within a short space of time. After removal from the nursery keep the plants covered with a piece of wet sacking to prevent the young seedlings from drying out.

About twenty-four hours before the plants are dug give the nursery bed a good watering. The roots of the young seedlings are thus less likely to be damaged by being dragged through the soil, and the plant will have absorbed also sufficient moisture to assist it to recover from the shock of transplanting.

Training the Vine.

From the beginning the grower should have a definite system in mind, and train the vine systematically, so that a good solid foundation is modelled on the trellis.

Light stakes or poles should be driven into the ground alongside the young seedlings and fastened firmly at the top to the wires on the trellis. The stakes act as supports for the vine until they have become firmly established on the wires.

Within a few weeks after transplanting the young seedlings will have become established and vigorous growth will develop.

The training of the vine should commence from the outset. With the production of vigorous growth numerous shoots will appear from the crown of the plant, also as side growths from the original stem. In most cases these latter growths are the more vigorous, and rapidly overtake the original growth of the vine. When they have attained a growth of from 12 to 18 inches in height the required number of the most vigorous growths should be selected to form the main stems of the vine. All other growth should then be carefully cut away. With the growth of the stems it is necessary to keep them tied at intervals of 9 to

12 inches to the stakes provided for that purpose, in order to prevent the young tender growth from being broken or damaged through being blown about by wind.

When tying up the stems tie first firmly to the support and then tie up young growth, leaving sufficient space for the expansion of the vine.

All side growths arising from the stems should be suppressed until the wires are reached, thus forcing all the vigour of the vine into the terminal growth.

The leaves on the main stems between the ground and the wires should be permitted to remain, as these shade the stem and assist in the natural development of the young plant. On reaching the wires, if

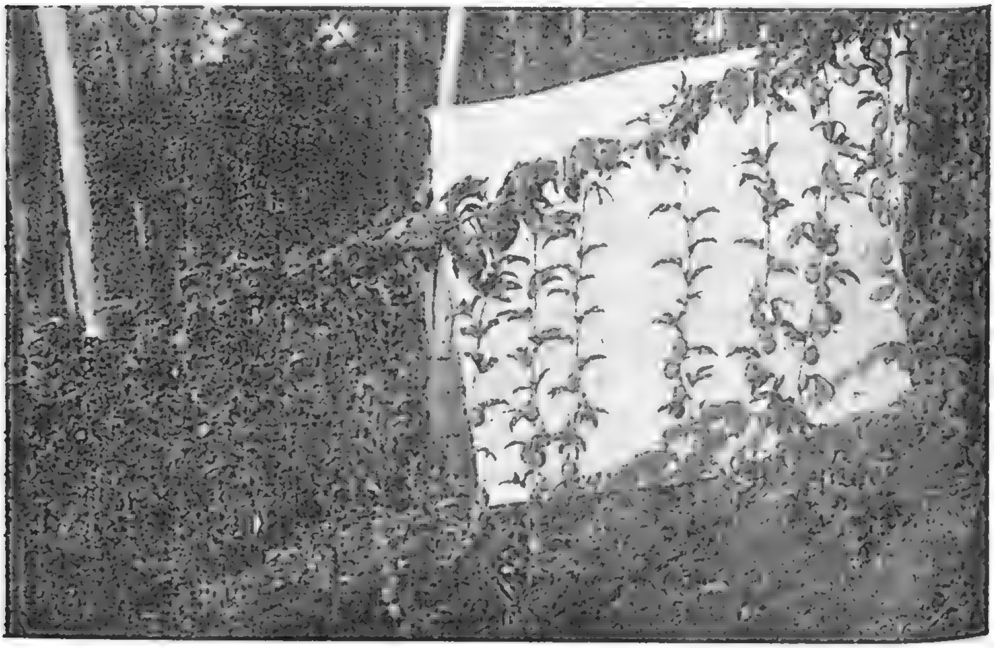


Plate 159.
Well spaced fruiting laterals on 10 months old vine.

only a single stem has been developed the terminal growth is pinched out. The vine will then put forth lateral growths from which the required number is selected to form the main leaders of the vine.

Where two or more stems have been selected there is no necessity to stop the terminal growth, for on reaching the wires the growth is directed along the trellis and forms the main leaders. The leaders should not be permitted to ramble along the trellis at will with only the tendrils to support them, but should be kept turned over the wires and tied in position at regular intervals, care being taken to maintain the turning in the same direction, thus preventing the formation of sagging loops in the leaders.

On the leaders becoming established on the trellis cut away all unnecessary tie bands, thus preventing the cincturing of the growth as it expands. As the leaders proceed along the wires lateral growth will develop, and this will be accelerated if leader terminals are cut back on reaching the approaching growth of the neighbouring vine.

Laterals should be permitted to develop at intervals of from 9 to 12 inches, and kept hanging straight down from the leader towards the ground, thereby preventing tangling while admitting light and air, which promotes the setting of the fruit, at the same time greatly lessening the labour of harvesting, spraying, and pruning.

All laterals should be kept shortened to within 6 inches clear of the ground.

The grower should give consideration to the system of growth to be developed by the young vines, and to whether a single or multiple stem system will be more suitable.

In the single stem system one stem only is allowed to grow until it reaches the height of the wires on the trellis, when the top is pinched out and leaders are developed from the subsequent growths at the head of the vine; while in the multiple stem system two or more stems as desired are developed to form the leaders on the trellis.

The development of two main stems is most popular on the South Coast, because more growth is produced in a short period, while the vines cover the trellis rapidly. A good crop is usually set within twelve to fifteen months, provided the vines have been planted at the right time and have been given the required amount of attention.

An added advantage of the multiple leader system over the single leader is that if one stem is lost or damaged the vine does not require complete reconstruction before another crop is produced, as sufficient growth from the undamaged leader will remain on the trellis to produce a crop until an additional stem is developed to replace the lost one. All main stems should be as nearly as possible of an even size, otherwise the more vigorous stem will rob the weaker, resulting in an unbalanced growth of the vine.

Vines trained on a single main stem take longer to establish a complete cover on the trellis, but during early life are much easier to keep in control, as the growth is not nearly so dense as that developed by the multiple stem system. Under this system the terminal growth is pinched out when the stem reaches the top wire, and the required number of leaders developed from the lateral growth promoted on the main stem.

In twelve to eighteen months the vines will have become well established on the trellis, carrying sufficient growth to produce a satisfactory crop in subsequent years. On flat land or land having only a gentle slope the leaders can be trained to grow in each direction on the trellis, but on steep slopes the vines naturally grow better towards the uphill direction. The vines should be trained to assist this natural tendency.

On sloping land two main leaders trained in the uphill direction will prove satisfactory, while on gentle slopes or on flat land four main leaders may be developed and trained, one to each wire in both directions.

[TO BE CONTINUED.]

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

THE heavy general rains experienced throughout the State have acted as a tonic on the fruit industry. Certainly fruit in season, like grapes, must suffer loss through excessive moisture causing splitting and loosening on the stems, but against this is the future development of crops now in the bud development stage.

Pineapples have lost in quality through excessive moisture. While too late to increase the coming season's crop—except, of course, where irrigation has been practised—the rain has given citrus trees a new lease of life. The rain in most cases possibly accounts for the slight easing in values experienced towards the end of March. Market values of fruit are as follows:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Bunches, 2d. to 7½d. per doz. Cases—Sixes, 6s. to 12s. 9d.; sevens, 8s. to 13s. 9d.; eights, 8s. to 14s. 9d.

Melbourne.—Sixes, 17s. to 18s.; sevens, 19s. to 20s.; eights and nines, 21s. to 22s. Owing to the shortage through floods 30s. was obained at one market.

Sydney.—Sixes, 13s. to 16s.; sevens, 15s. to 17s.; eights and nines, 16s. to 20s.

It is expected that the market will ease slightly during April, but values should again be high from May onward. Attention of growers is called to the introduction of the Cluster Pack as from this month, also the new one-bushel case, which should facilitate handling. Particulars of both improvements are obtainable in a free booklet issued by the Department of Agriculture. Growers are asked to co-operate in the application of these improvements, which will make work easier and the risk of disease less.

Pineapples.

Pineapple values in Brisbane eased considerably. Prices:—

Brisbane.—Cases, 2s. to 4s. Loose, 2s. to 4s. per dozen. Roughs were approximately the same value.

Melbourne.—10s. to 14s. per case.

Sydney.—8s. to 10s. per case.

Practically all lines sent to Southern markets have been affected with water blister.

Tests have shown that the new banana bushel case, 18 inches long by 13 inches wide by 9½ inches deep, inside dimensions, is quite a good box; all sized fruit packs head and tail giving the following counts—8, 10, 12, 15, and 18. Altogether it is a very suitable case, particularly for the country order trade in which buyers want small cases.

Custard Apples.

Early consignments of this luscious fruit are now on the market. Up to 8s. for special quality fruit was obtained. Growers are warned against sending immature lines. A creamy colour in the interstices of the fruit is a good indication of maturity.

Papaws.

Prices are high for good quality fruit, 8s. to 11s. per tropical fruit case being obtained in Brisbane. Growers contemplating sending to Southern markets must exercise care in packing fruit that is not too advanced in ripeness.

Avocados.

Small consignments sent to Melbourne have realised up to 16s. per half-bushel case. Remember, this is a specialised fruit; do not spoil its future consumption development by sending to market immature fruit, which, if it does ripen, is flavourless. Present indications show that it will be a long time before the supply will overtake the demand.

Monsteras.

Melbourne.—4s. to 6s. per half-bushel case. Quite a trade is being worked up in this fruit in Melbourne.

CITRUS FRUITS.

New season grape fruit is now on the market. It is certainly remarkable the way one season's citrus production runs into another. A few early oranges have been sold at satisfactory prices. Growers must remember that a citrus acidity test is used, and oranges before going on the market should pass this test. Following are particulars of the test:—

In the case of oranges, grape fruit, and mandarins, fruit in which the weight of the hand-pressed juice is not less than 30 per centum of the total weight of the fruit, and—

(*a*) As regards navel oranges and mandarins, 10 cubic centimetres of which juice is neutralised by not more than 26 cubic centimetres of deci-normal (N/10) alkali; and

(*b*) As regards oranges (other than navel oranges and mandarins) 10 cubic centimetres of which juice is neutralised by not more than 30 cubic centimetres of deci-normal (N/10) alkali.

Lemons are still maintaining satisfactory values.

Oranges.

Prices in Brisbane for oranges:—Locals, 10s. to 12s. per bushel case; Gayndah, 12s. to 14s. per bushel case.

Sydney.—6s. to 12s.

Melbourne.—6s. to 16s.

Lemons.

Brisbane.—Gayndah, 8s. to 13s.; Benyenda, choice, 15s. to 16s.; standard, 12s. to 13s.

Sydney.—Locals, 6s. to 10s. per case; Queensland, 14s. to 17s. per case.

Melbourne.—Gayndah lemons, 14s. per case.

Grape Fruit.

Brisbane.—6s. to 8s. per bushel.

Sydney.—Queensland, 14s. to 17s. per bushel; Palestine, imported, 35s. per one and a-half bushel export case.

Melbourne.—16s. to 20s. per bushel; imported, Palestine, 45s. per export case.

Passion Fruit.

Brisbane.—7s. to 8s.; second grade, 1s. per case lower.

Sydney,—3s. to 8s.

Melbourne.—4s. to 9s. per half-bushel.

DECIDUOUS FRUITS.

Apples.

Early export prices have been of a payable nature, returning the equivalent of 6s. to 9s., f.o.r. Stanthorpe.

Local prices are not as satisfactory as they might be, but should improve as the maturity of Granny Smiths improves and the marketing of export culls lessens.

Brisbane prices for apples.—Granny Smith, 6s. to 8s. 6d.; Jonathan, 6s. to 7s.

Grapes.

Considerable waste is being experienced after the heavy rains. Generally this season the quality has been excellent. Prices:—

Brisbane.—Muscats, 4s. to 5s. 6d. per half-bushel; Waltham Cross, 3s. to 5s.; Purple Cornichon, 5s. to 6s. 6d.; Colemans, 3s. to 4s.

Stanthorpe Rock Melons.—2s. to 4s. per bushel case.

Tomatoes.

Brisbane.—Coloured, 2s. to 3s. 6d.; green, 1s. to 2s. 6d.; ripe, 1s. to 2s.

Melbourne,—2s. to 5s.

Cucumbers.

Brisbane.—2s. to 4s. per bushel case.

Sydney.—2s. to 5s. per bushel case.

Publications.

The Banana Packing booklet is now available for distribution. Copies may be obtained free on application to the Under Secretary, Department of Agriculture and Stock, Brisbane. The publication, in addition to illustrating all the packs now in use, deals with the marketing of the bushel case. A leaflet on Rock Melon packing is ready for distribution. Lettuce packing is also obtainable.

A COMMON CAUSE OF LOW-GRADE CREAM.

Careless washing of utensils is a common cause of low-quality cream. Contamination may result from:—Failing to wash up twice daily. Washing up with cold water, either once or twice a day. Leaving the separator unwashed at night. Failing to use washing soda to remove grease from utensils. Using objectionable cloths or unclean brushes for washing up. Failing to scald thoroughly all utensils, brushes, &c., after washing. Failing to wash and scald cans on their return from the factory. Washing up utensils in polluted water—rainwater is always preferable.

The Tropics and Man

The Climates of Queensland.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology, University of Queensland.

No. 4.

I SPOKE last time of a technical device which allowed us to turn the three important and variable factors in climate into a single figure which meant something concrete, and which could be used to compare one climate with another in so far as it affects man. This single figure is called "effective temperature." You may ask what is wrong with the present method of comparing ordinary temperatures, as given by the Weather Bureau each day. If you have been following the theory of this business, you will remember that ordinary (dry-bulb) temperatures take no account of humidity and no account of air-movement. How often have you heard people discussing the weather—

Mrs. A.: Phew! Isn't it hot to-day?

Mrs. B.: Yes! The thermometer only says 82, but it's the humidity! or another day,

Mrs. A.: It's 110 in my kitchen to-day!

Mrs. B.: It's hot alright, but I don't mind the dry heat so much; it's the humidity that gets me down.

These two ladies are apparently agreed that a dry 110 degrees is no worse, or may even be better than a wet 82 degrees. Most people, again, as far as climate is concerned would prefer to be in Cloncurry with a temperature of 90 degrees than in Townsville with a temperature of 82 degrees.

Obviously, then, any system which takes no notice of humidity is fallacious, if we are going to compare weathers or climates as they affect man.

How the Climates are Compared.

For over fifty years the Weather Bureau has been keeping records all over Australia of temperatures, humidity, rainfall, &c. At all stations observations are made at 9 a.m. At many these are repeated at 3 p.m. At some stations further readings are made at 9 p.m., while at a very few stations continuous records are made. There have accumulated vast amounts of information of a most useful character. Unfortunately, these are for the most part unpublished. The Bureau, however, very kindly supplied us with the information we wanted—the average dry-bulb and wet-bulb temperatures for each month of the year at each of eighty-four stations throughout Queensland and the Northern Territory. Using the American figures we were able to work out the average "effective temperature" for each month of the year at each of these stations. We then had figures for the different places which could be compared without worrying unduly about other disturbing factors. Both temperature and humidity were accounted for. We then proceeded to study the figures, and the results proved to be well worth the trouble we had expended upon them.

Results of Enquiry.

The first point which struck us upon examining these "effective temperatures" was that the figures agreed very much more closely with one's own experiences. Instead of Cloncurry having a temperature of 90 degrees and Townsville one of 82 degrees, both now had the same figure of 79 degrees. This means that both Cloncurry and Townsville during this month have the same general effect *upon the human body,* and that this effect is the same as an atmosphere saturated with water vapour at a temperature of 79 degrees. That Cloncurry and Townsville, in spite of differences in ordinary temperature, do have the same general effect upon one's comfort and efficiency in summer is, I think, a common experience.

To look at the other side, if one trusted to ordinary temperatures alone one would be tempted to say that Charleville in the south-west had the same effect in summer as Cooktown on the north-east coast, both having an average temperature of 83·5 degrees. This is quite foreign to one's experience, and when the "effective temperatures" are worked out we find that Charleville is considerably milder than Cooktown (76 degrees as against 80 degrees).

When maps are made of the hot month temperatures, the usefulness of "effective temperatures" in comparing the effects of climate upon man is very well seen. During the hot months the ordinary temperature rises as one goes west, but changes surprisingly little as one goes north. Effective temperatures, on the other hand, rise as one goes north, and change very little except for the mountainous regions as one goes west. There is no doubt that the latter changes agree very much more with one's experiences.

The second result of the enquiry, and one of more real importance to Queensland, is that we can determine in the laboratory just what effects a certain "effective temperature" will have upon a man at rest, or upon a man at work, and determine also whether his efficiency is lowered by that temperature or what strain he is likely to suffer.

Determining the Effects of Climate.

To solve a large and complicated practical problem involving living beings nearly always means investigation along two lines. In the first place the problem must be studied in its natural surroundings and as many observations made about as many features as possible. This method alone, however, usually results in a jumble of disjointed bits of knowledge, whose relation to one another can only be guessed at. If efficiency is lower in a place with a higher temperature it does not follow that the higher temperature is the cause of inefficiency. The food may be poorer, the social life may be worse, the type of people there may not be so good, and so on. If one tries to sort out all these possible causes merely by enquiry one becomes hopelessly confused.

It is here that the second method comes in—that of experiment. To continue with the example, the *same* people, eating, the *same* food, working under exactly the *same* conditions, can be tried out at different temperatures and their efficiency measured. Such an experiment will show to what extent temperature is to blame. The importance of diet and even of social conditions can likewise be investigated.

Taken alone the experimental method has its drawbacks, too. An artificially made climate is not the same as a natural one; people do not behave in the same way when put into a hot room as they do when working in a hot climate. The ideal way is run natural observations and experimental work side by side and make each check the other.

This then is the method whereby we hope to set about investigating the effects of Queensland climates upon man. Extensive and continuous observations and tests will be made upon people following different occupations and leading different lives in different parts of the State. At the same time the effect of artificial climates will be determined in the laboratory upon unacclimatised and acclimatised people doing different kind of work, eating different kinds of food, and so on. Constant comparison of one set of results with the other will go on, and fresh avenues of investigation will be followed up as suggested by the earlier enquiries.

This means a long, continuous, and exhausting programme. Without it we can but continue with our blind guessing, and blind guessing will provide us with our just deserts—failure in the face of increasing competition.

Other Climatic Factors.

I have been concentrating upon three of the climatic factors—heat, humidity, and air movement. These are universal in operation and are undoubtedly the most important. Moreover, they can be conveniently measured and a method has been devised for dealing with all three at once. But there are other factors whose presence we must not forget. They are not always in the picture and about some of them we know very little. Nevertheless, they must not be ignored. The first and most important of these interfering factors is radiation. There are a whole group of radiations, of which heat is one. The effects of these I want to mention next time, since there is an immense amount of misconception abroad about them.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of February, 1937 (273 days unless otherwise stated.)

Name of Cow.	Owner.	Milk Production.	Butter. Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Alfa Vale Model 2nd.'	W. H. Thompson, Nanango	1,5430·9	713·544	Reward of Fairfield
Princess 2nd of Trevor Hill	J. Phillips, Sunny View, Wondai	17,386·8	677·763	Prince of Braemar
Cameo of Braemar	A. H. E. Black, Kumbia	12,132·0	543·971	Victory of Balmoral
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Kyabram Marie 2nd	A. H. E. Black, Kumbia	10,329·0	422·655	Springlands Bridadier
College Stateley 5th	Queensland Agricultural High School and College, Gatton	6,016·83	285·47	Fussy's Kitchener of Hillview
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Newhaven Calm	E. O. Jeynes, Raceview	9,621·5	431·943	Fairy Bower Brilliant
College Rascal 5th	Queensland Agricultural High School and College, Gatton	7,316·51	309·978	Fussy's Kitchener of Hillview
	JERSEY.			
	JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.			
Bellgarth Pearl	D. R. Hutton, Bellgarth, Cunningham	7,829·25	433·045	Trecarne Renown II.
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Kingsford Dell	W. E. Meirs, Rosevale	4,922·0	297·972	Oxford Saturn
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Kathleen Royal Wren	J. Goostrey, Bald Knob	6,084·75	316·91	Retford Royal Atavist
Prim Lady of Hope View	H. T. C. Gibson, Kingaroy	5,421·0	282·421	
Wyreene Rosette	J. B. Keys, Gowrie Little Plain	4,933·75	257·551	Lyndhurst Majesty

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Grasses from Dawson Valley Identified.

J.M. (Wowan)—

(1) *Eragrostis pocoides.* A species of love grass most frequently occurring in Queensland as a weed of cultivation. We cannot say that we have seen stock take readily to it, but in the form of hay it would probably be eaten readily enough, and this seems to apply to a number of grasses.

(2) *Dichanthium* sp., a species of blue grass. All the blue grasses are generally regarded as excellent fodders. The genus Dichanthium is at present under review, and we cannot give you a specific name.

(3) *Paspalidium caespitosum,* brigalow grass.

(4) *Dactyloctenium radulans,* button grass. This is a very common grass on parts of the Downs and in the West. Like Flinders grass it is often eaten when quite dry. It produces an abundance of seed heads, and in this stage is said to be quite nutritious.

(5) *Sporobolus pallidus,* fairy grass. This is one of the grasses that come up very quickly after summer rains. We have little information about its food value, but it is generally recognised as of second-class value. However, like some other native grasses, it is a useful addition to the average native mixed pasture.

(6) *Chloris acicularis,* curly chloris or curly windmill grass. It makes good bottom feed, but does not spread by means of runners to the extent of some of the chloris grasses.

(7) *Panicum Buncei,* a native panic grass. Most of the native panic grasses are regarded as excellent grasses in the mixed native pasture.

Wild Millet. Warrego Summer Grass. Phalaris bulbosa.

T.G. (Nerang)—

(1) *Echinchloa crus-galli,* wild millet or swamp millet, an excellent grass for wet situations. It is very closely allied to such well-known cultivated fodders as Japanese millet and white panicum.

(2) *Paspalidium flavidum,* sometimes called Warrego summer grass, fairly wildly spread in Australia and favouring flooded country. In such situations it is generally regarded as an excellent fodder.

Regarding *Phalaris bulbosa,* we do not know how this came to be mentioned as a legume. It was either a slip of the pen on our part or just one of those mistakes that will occur at times. As you surmise, it is not a legume but a true grass. All the legumes have pea flowers and seed pods.

Wild Mint.

W.H. (Dalby)—

Your specimen represents *Salvia reflexa,* the wild mint, or narrow-leafed sage. This plant has received a good deal of Press publicity due to its being such a serious pest on parts of the Darling Downs. Feeding tests prove it to be poisonous to stock, but most of the trouble experienced has been with travelling stock, ordinary paddock or resting stock seeming to browse among the plant with impunity.

If you have only a small patch the best means of eradication is, of course, to pull the plants out and carefully burn. I take it the plant is a new-comer to your district, and this would be practical at the present time and the most certain method of getting rid of the weed. The plant you forwarded did not bear many seeds, but as the seeds ripen very quickly, eradication should be carried out as soon as possible.

Barrier Salt Bush.

F.W.M. (Ducklo)—

The specimen represents *Enchylaena tomentosa*, the Barrier salt bush, a plant of the salt bush family, Chenopodiaceae. It is very common in cleared brigalow and belah country in Queensland. It is not known to possess any poisonous or harmful properties, but as far as we have observed stock do not seem to eat it, at least to any extent. We cannot say we have seen it become a serious pest on the Brigalow country.

"Coffee Bush" or Arsenic Bush.

H.C. (Mackay)—

The plant is *Cassia occidentalis*, a very common weed in North Queensland, sometimes known as "coffee senna" and at other times as "arsenic bush." The latter name is applied to several plants of the genus Cassia in North Queensland and is rather misleading. Feeding tests have been carried out with your particular plant, yielding negative results, except that the animals experimented with showed considerable purging. This is to be expected, as species of Cassia provide the senna of commerce, and practically all the members of the genus possess purgative properties.

Prickly Poppy.

J.F.D. (Mackinlay)—

Your specimen represents *Argemone mexicana*, the prickly poppy, a very common farm weed in parts of Queensland. In the North and Central-West it seems to be confined to level flats and apparently has not spread very much, for we remember seeing a few odd specimens growing about Julia Creek a good many years ago. The plant might become a serious pest on some of the alluvial country, however, for in such places on the Downs and in the neighbourhood of Brisbane it is sometimes very abundant.

So far as we have observed, we cannot say that we have ever seen it eaten by stock, but it is reputed to be poisonous. The only cases of poisoning by it have been where it has been cut, allowed to wilt, and the subsequently softened plants fed to poddy calves.

In addition to being spiny, the plant contains an intensely bitter sap which renders it unpalatable to stock.

Grasses from Central-West Identified.

L.R.B. (Blackall)—

(1) *Chrysopogon pallidus*, a very common grass throughout the whole of the Central-West and generally regarded as quite a good fodder.

(2) *Sporobolus actinocladus*, a small grass, moderately common in many places, and makes rather good bottom feed for sheep.

(3) *Enneapogon nigricans*, blackheads. A very common grass in parts of the West, generally regarded as of only secondary value as a fodder.

(4) *Brachyachne convergens*, sometimes called star grass. It is quite a luscious-looking grass, but stock do not seem to take readily to it.

(5) *Enneapogon avenaceum*, white heads.

(6) *Paspalum dilatatum*, common paspalum. This grass is very extensively cultivated on the coastal areas, particularly after the burning of big scrub.

(7) *Digitaria divaricatissima*. This is one of the roly-poly or umbrella grasses, the seed head breaking off and rolling about.

NOTICE TO SUBSCRIBERS.

When renewing your subscription, write your full name plainly, preferably in block letters.

Address your renewal to the Under Secretary, Department of Agriculture and Stock, Brisbane.

General Notes

Staff Changes and Appointments.

Mr. C. E. Ellis, Inspector of Stock, Killarney, has been appointed District Inspector of Stock, Department of Agriculture and Stock, and the Stock District of Warwick has been assigned to him.

Mr. E. W. B. Da Costa (Sandgate) has been appointed Assistant to Plant Physiologist, and Mr. H. M. Groszmann (Woongoolba) Assistant to Horticultural Research Officer, Department of Agriculture and Stock.

Mr. W. J. Park, Cadet (Pig Branch), has been appointed Inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Mr. A. C. P. Nurcombe, Assistant Grader (Senior), Cotton Section, Department of Agriculture and Stock, has been transferred to the Glenmore Ginnery, Rockhampton.

Mr. A. R. Nott, Government Veterinary Surgeon, Blackall, has been transferred to the Animal Health Station, Yeerongpilly.

Mr. R. Small, Fairymead, Bundaberg, has been appointed an honorary ranger under the Animals and Birds Acts.

Mr. N. A. Anderson, loader for the Committee of Direction of Fruit Marketing at Burrum, has been appointed also an inspector under the Diseases in Plants Acts.

Mr. A. V. Thorp, Moreton Mill, Nambour, has been appointed millowners' representative on the Moreton Local Sugar Cane Prices Board.

Citrus Levy Regulation.

Approval has been given to the extension of the Citrus Levy Regulation, passed in April, 1936, for a further twelve months, as from the 1st March, 1937.

The Regulation empowers the Committee of Direction of Fruit Marketing to make the levy at the following rates:—

(a) On all citrus sold, consigned, or delivered whether by rail, road, or boat to factories, at the rate of 5s. per ton.

(b) On all citrus sold, consigned, or delivered by rail to any agent, person, or firm other than a factory, at the rate of 3s. 2d. per ton, with a minimum of 2d., but no levy is collected on single case consignments.

(c) On all citrus sold or delivered other than by rail to any railway station to any agent or person other than a factory, at the rate of 1d. per case.

Slight amendments of the Regulation include the reduction, in paragraph (b), of the minimum levy to 1d. instead of 2d., and in paragraph (c), an alteration to the effect that the levy shall be 1d. per bushel case, or ½d. per half-bushel case, with a minimum of 1d.

Open Season for Duck and Quail.

An Order in Council issued under the Animals and Birds Acts declares the periods of close season for duck and quail throughout the State. In effect, this will mean that the open season for duck and quail in the three divisions of Queensland will be:—

(a) *In Southern Queensland*—

For wild duck.—From 1st April to 31st August.

For quail.—From 1st May to 30th September.

(b) *In Central Queensland*—

For duck and quail.—From 1st July to 30th November.

(c) *In North Queensland*—

For duck and quail.—From 1st June to 31st October.

Packing and Grade Standards for Cavendish Bananas.

Amendments of the Fruit and Vegetable Grading and Packing Regulations issued under the Fruit and Vegetables Acts have been approved. These describe the measurements and capacity of a one-bushel banana case, and prescribe grade standards for Cavendish bananas.

The banana case shall be 18 inches long by 13 inches wide by 9½ inches deep, and its capacity shall be not less than 2,223 cubit inches.

The grade standards provide for cased bananas being divided into two grades—"Standard" and "Large." "Standard" shall mean sound fruit from 6½ to 7½ inches in length, with a minimum circumference of 4 inches. "Large" grade shall mean sound fruit over 7½ inches in length, with a minimum girth of 4½ inches, with a variation of not more than 1½ inches in length of fruit in any one case.

Sugar Levy.

Regulations have been issued under the Primary Producers' Organisation and Marketing Acts empowering the Queensland Cane Growers' Council to make a particular levy on all growers of sugar cane at the rate of one halfpenny per ton of sugar cane harvested during the coming season, the amounts raised by the levy to be expended on matters of an economic, legal, or compensatory nature, where such matters are of vital importance to the sugar industry generally.

One hundred growers of sugar cane may, on or before the 19th April next, make a request to the Minister for a poll on the question of whether or not the levy should be made.

Quarantine Area for Sugar-cane Plants.

A Proclamation issued on the 16th May, 1936, under the Diseases in Plants Acts, declared a quarantine area in portions of the parish of Sophia, Mulgrave district, on account of the prevalence of gumming disease of sugar cane, and prohibited the removal of sugar-cane plants from this quarantine area.

During the heavy wet season of last year the gumming disease outbreak in the Mulgrave area spread considerably, and it has become necessary to increase the size of the quarantine area in consequence. A Proclamation has been issued rescinding the one abovementioned, and extending the boundaries of the quarantine area in the Mulgrave area. The removal therefrom and planting therein of certain varieties of sugar cane is prohibited.

Veterinary Surgeons Board.

Executive Council approval has been given to the issue of a Proclamation bringing "*The Veterinary Surgeons Act of* 1936" into operation as from the 11th March. This Act makes provision for the registration of veterinary surgeons for which, and other purposes of administration, the Veterinary Surgeons Board has been constituted. This Board consists of Professor H. R. Seddon, D.V.Sc., Dean of the Faculty of Veterinary Science, University of Queensland; Colonel A. H. Cory, M.R.C.V.S. (L.), Chief Inspector of Stock; Messrs. E. F. Sunners, Chairman of the Queensland Meat Industry Board; J. W. Irving, M.R.C.V.S. (L.); and G. Mackay, Veterinary Surgeons. Mr. H. S. Iliff, Deputy Registrar of Brands, Department of Agriculture and stock, has been appointed Registrar of the Veterinary Surgeons Board.

A person is entitled to be registered as a Veterinary Surgeon under the Act who—

(*a*) is a holder of a degree or diploma in veterinary surgery of a university or is a member of a college of veterinary surgeons recognised by the Governor in Council;

(*b*) has undertaken a training course at, and has passed the examination prescribed by, a training institute within the Commonwealth of Australia, and approved by the Governor in Council as affording a training in veterinary science;

(*c*) has, previous to the commencement of this Act, been for a period of at least five years engaged *bonâ fide* in the practice of veterinary surgery in Queensland.

Provision is made for applications for registration as veterinary surgeons to be submitted to the Board. Regulations have also been approved which will give effect to the provisions of the Act. An Order in Council issued under the Act declares that certain operations done in connection with animal husbandry shall not constitute the practice of veterinary surgery.

Rural Topics

Standover Cotton—A Menace to Adjacent Cotton Fields.

Many farmers in the main cotton-growing areas are planting this season the whole or part of their acreage of cotton on newly broken grassland, and intend planting the old cotton fields with Rhodes grass, as the soundness of the grassland-cotton rotation has been amply borne out during the past season. It appears likely, however, that many old cotton fields will be left either as "standover" for some months, or in some cases, until the land is prepared for wheat or winter feed.

There is ample evidence to show that standover fields, through the prolific weed growth associated with them during the spring and summer months, are breeding centres for some of the major cotton pests, such as cutworm and corn ear worm, and are, therefore, a menace to adjacent fields of growing cotton. Over a series of years there have been recorded migrations of cutworms, and during the 1934-35 and 1935-36 seasons migrations of corn ear worm, from weedy standover fields to nearby seedling cotton which have caused substantial loss of stand. The weed growth is also responsible for a big increase in corn ear worm population during January and February, and heavy loss of squares and bolls in crops adjacent to a weedy standover field has occurred even in seasons of generally moderate corn ear worm attack. It is thus imperative that the grassing of standover fields be effected as soon as practicable, to eliminate completely the danger associated with weed growth adjacent to the new cotton.

Although fair stands of Rhodes grass have occasionally been obtained by sowing the seed between the rows of old cotton stalks of the "standover" field during February and March, this practice is not recommended, as more often a thin scattered stand results, and which is insufficient to smother weed growth. The growth made by Rhodes grass planted under such conditions is also usually slow, due to the surface soil being packed hard by the summer rains. It is, therefore, recommended that all standover fields be ploughed before any spring weed growth is apparent, further cultivation being given as is necessary to destroy any weed growth occurring afterwards and to establish a fine seedbed.

The preparation of a suitable seedbed for Rhodes grass is undoubtedly advisable, particularly on the old cotton cultivations of the forest soils, as this not only assists in the establishment of the seedlings but also ensures of a good supply of nitrate-nitrogen in the upper soil to promote a quick vigorous growth of grass.

As the idea of sowing the Rhodes grass on the old cotton cultivation is to check weed growth, improve the physical condition through the development of a large population of grass roots and reduce the nitrate content of the soil, it is advisable to sow the grass at a rate sufficient to give a thick even cover. In this respect it should be appreciated that Rhodes grass usually germinates only moderately well, so a good rate of sowing should be used—preferably 8 to 10 lb. per acre. Care should also be exercised to avoid sowing too deeply—dragging a brush harrow after broadcasting the seed usually gives ample cover in a normal season.—A. NAGLE, Senior Instructor in Cotton Culture.

Giant Setaria (Giant Panicum).

In the past more or less confusion has arisen in connection with the sale for sowing of so-called panicum seed—*Setaria italica.* Botanically the seed in question is not a panicum, but belongs to the genus Setaria, a common collective name for which is "foxtail millet."

At the present time, *Setaria italica* (so-called panicum) may be divided into three main types, viz.,—giant, dwarf, and an admixture of both. The so-called giant panicum offered for sale in Queensland is frequently a mixture of the giant and dwarf varieties. In order to clarify the position, it has been decided that the giant and dwarf varieties shall be respectively called giant setaria and dwarf setaria. To ensure that these products will not lose their identity so far as farmers and others are concerned, they should be referred to in catalogues and other publications as follows:—

Giant Setaria (Giant Panicum), and
Dwarf Setaria (Hungarian Millet).

It may be mentioned that the identitification of the giant or dwarf varieties is comparatively simple, and is carried out by the Seed Testing Station, Department of Agriculture and Stock, Brisbane, a period of about fourteen days being required for the purpose. It is intended at an early date to publish an illustrated article on this subject, and pamphlets will be made available to those interested.—F. B. COLEMAN, Pure Seeds Branch.

Dehorning Cattle.

The Royal National Association offered substantial prize money for pens of bullocks suitable for the export chilled beef trade, i.e., of approved breed, liveweight about 1,100 lb., age not to exceed four years. The number of entries was large, and the high standard reached by all exhibitors was very gratifying.

It is a great pity that all who saw the stock "on the hoof" did not see them "on the hooks."

The quiet, contented appearance of the animals shows they had been well handled, the full cods, steady, bulging eyes, and the sleek hides showed they had been well finished. Any observer would have classed them as prime killers. They were. The dressed weight, 650-700 lb., met the requirements of the English market. The conformation, covering of fat, depth, and evenness of flush left little or nothing to be desired. One animal aged twenty months dressed over 700 lb.

These animals must not be regarded as something extra special—something seen only at exhibitions. During the second quarter of the year thousands of such "fats" are trucked to the slaughter-houses. They leaves the homesteads in just the condition these "Exhibition" bullocks left, yet on slaughter many of the best carcases are so badly bruised that they must partly or wholly be condemned.

The loss is borne by every section of the trade, from the grower, whose stock are "marked down," to the treatment works, where loss of time in dressing such carcases means loss of money. Wherein lies the difference?

The terms of the Royal National Association's competition included " . . . . polled, dehorned, or tipped bullocks . . . ."

By far the greater number of fats trucked to the meatworks are Herefords or their crosses. Each animal carries a pair of bayonets in the form of horns. In old animals the spread of these horns is remarkable. Anyone with the slightest knowledge of cattle recollects that the normal position of the head is drooped, but when roused the animal throws its head quickly into a raised position. Each disturbance evokes such an action, and what happens among horned stock in the close confines of a railway carriage can easily be imagined. Struggles develop, beasts "get down," hooves score the fallen animal, horning takes place, and in the general fracas hips are broken, shoulders and ribs are contused. Losses which no one can afford occur.

It is often possible for cattle owners to walk large mobs to the meatworks. With careful management, the loss from bruising is small, but the loss in condition is appreciable.

Rail transport means such a saving in time that it is the recognised method of bringing stock from distant properties to the works.

Some bruising admittedly, and quite unavoidably, occurs in handling and working cattle, in the trucking yards and from the trucks themselves—particularly when stoppages are frequent—but most of the damage is wrought by horns. The obvious thing is to dehorn.

The ideal thing would be to breed hornless types. This practice is common in other beef cattle countries, but in Queensland it is not entirely practicable.

Dehorning at the calf stage is by far the easiest and most economical method. The operation can be done when calves are yarded for branding, castrating, or for any other purpose. Efficient instruments are available for "scooping out" the horn bud. Chemicals for suppressing horn development are also obtainable.

Failing an early dehorning, the animals should be dehorned, partly or wholly, at the beginning of the fattening period. Breaking off the horn with the aid of a hollow lever is cruel and dangerous; sawing off the unbleached, i.e., growing, portion of the horn is simple and painless. Complete dehorning of the adult animal should only be done with suitable veterinary instruments. These are obtainable in a variety of makes. They are strong, easy to use, and obtainable in Australia. Most agents are willing to demonstrate the operation. A suitable antiseptic, such as fat and Stockholm tar, should be smeared over the exposed base. As a last resort, the animals should be dehorned immediately prior to trucking.

Any notes on the advantages of dehorning would be incomplete without some reference to the animals themselves.

Dehorning largely eliminates the domineering type of animals. Horned stock should never be run with hornless. The rule should be "all or none," for even the most craven horned beast soon becomes a bully among the hornless. Hornless animals are more contented and quieter. They make more rapid gains in weight. They "handle" better, and settle down to new conditions quicker. Moreover, you can put more of them in a truck.—Dr. M. WHITE.

Sulphuring of Pineapple Soils.

Within the past few seasons the application of sulphur to pineapple soils has been widely practised, and its effect has been of great value in the control of pineapple "wilt disease." The function of sulphur is not that of a fertilizer; its value lies in the fact that it will increase the acidity or pH of the soil. It is now generally recognised that, under certain conditions, an acid soil is required for pineapple cultivation, and this is particularly the case with regard to the sandy forest areas.

The chief reason for this is that with the increased acidity the iron in the soil becomes more readily available to the plant. The presence of iron is necessary for the functioning of the chlorophyll, which is the green colouring matter of the plant leaf.

The amount of iron in the sandy forest soils is very low, and, as usually only a small part of the iron is available to the plant, it so happens that, after being cropped for a few years, this iron is all used up. This condition may be remedied by the application of sulphur, for, with the resulting increase in acidity, a sufficient quantity of iron will again become available. The response to this treatment can be detected by observing that there is a general improvement in the colour of the plant, and the new growth will be green and vigorous, in marked contrast to the pale, lifeless appearance of the previous condition.

With the heavier types of loams, and in particular the red volcanic loams, the application of sulphur is not always necessary, due to the sufficiency of available iron naturally present in the soil. However, it is a fact that in many of these heavy soils, which contain normally ten to twenty times the amount of total iron of the sandy soils, there is only a very small amount of this available, and consequently there will be a definite response to sulphuring.

In sandy soils, the pH test may be regarded as an index of the availability of the iron, and, except in the case of some virgin areas, if the pH is much above five, the application of sulphur can be confidently recommended. The amount of sulphur varies with the soil, but generally 2½ to 3 cwt. per acre should suffice for the light-coloured very sandy types. For those which are of the nature of a sandy loam, a heavier dressing of 4 to 5 cwt. per acre is necessary. With loams, and the red volcanic soils, dressings of less than 6 to 7 cwt. per acre are of little use, and, moreover, before these heavy dressings are made, advice should be obtained as to whether they are necessary, and will warrant the expenditure.

As the period in which the effect of sulphur becomes noticeable is about one to two months in the summer and at least three to six months in winter, it is advisable to apply it as soon as possible, i.e., a month or so before planting. The land should be brought to a fine tilth, and the sulphur broadcast by hand. Powdered sulphur is on the market; it is of the required degree of fineness, and is cheaper than the very fine flowers of sulphur. If at all lumpy, it should be rubbed through a sieve before distributing, in order to ensure an intimate admixture of the sulphur particles with the soil. The best time to apply is early in the morning, or on a still day, and it is very advisable to wear some form of protecting goggles, as the fine particles of sulphur cause considerable irritation to the eyes. The sulphur is then scarified in to a depth of about 4 inches; this is preferable to turning it in deeper by ploughing.

Sulphur may be applied with benefit to plants showing iron deficiency, up to twelve months old; the response, however, is not as marked as when it is applied before planting. In this case, it should be applied to the soil fairly close to the base of the plant, and then chipped in. It must be clearly understood that the sulphur should be applied to the soil itself, and that any portion lodging in the base of the leaves will be wasted. Note that this is different from fertilizer practice, for sulphur, unlike a fertilizer mixture, must be applied directly to, and thoroughly incorporated with, the soil for any reaction to take place.

Finally, it must be pointed out that the health and growth of the young plant is all important, and therefore the great value of sulphur lies in its use as a preventive and not as a cure.—L. G. VALLANCE, Analyst.

Orchard Notes

MAY.

THE COASTAL DISTRICTS.

IN these notes for the past two months the attention of citrus-growers has been called to the extreme importance of their taking every possible care in gathering, handling, packing, and marketing, as the heavy losses that frequently occur in Southern shipments can only be prevented by so treating the fruit that it is not bruised or otherwise injured. It has been pointed out that no citrus fruit in which the skin is perfect and free from injury of any kind can become blue-mouldy, as the fungus causing the trouble cannot obtain an entry into any fruit in which the skin is intact. Growers are, therefore, again warned of the risk they run by sending blemished fruit South, and are urged to exercise the greatest care in the handling of their fruit. No sounder advice has been given in these notes than that dealing with the gathering, handling, grading, packing, and marketing, not only of citrus, but of all other classes of fruit.

It is equally as important to know how to dispose of fruit to the best advantage as it is to know how to grow it. To say the least, it is very bad business to go to the expense of planting and caring for an orchard until it becomes productive and then neglect to take the necessary care in the marketing of the resultant crop. Main crop lemons should be cut and cured now, instead of being allowed to remain on the tree to develop thick skins and coarseness. As soon as the fruit shows the first indication of changing colour or is large enough to cure down to about from 2¼ to 2½ inches in diameter, it should be picked, care being taken to handle it very gently, as the secret of successfully curing and keeping this fruit is to see that the skin is not injured in the slightest, as even very slight injuries induce decay or specking. All citrus fruits must be sweated for at least seven days before being sent to the Southern States, as this permits of the majority of blue-mould infected or fly-infested fruits being rejected. Citrus trees may be planted during this month, provided the land has been properly prepared and is in a fit state to receive them; if not, it is better to delay the planting till the land is right.

In planting, always see that the ground immediately below the base of the tree is well broken up, so that the main roots can penetrate deeply into the soil and not run on the surface. If this is done and the trees are planted so that the roots are given a downward tendency, and all roots tending to grow on or near the surface are removed, the tree will have a much better hold of the soil and, owing to the absence of purely surface roots, the land can be kept well and deeply cultivated, and be thus able to retain an adequate supply of moisture in dry periods. Do not forget to prune well back when planting, or to cut away all broken roots.

All orchards, pineapple and banana plantations should be kept clean and free from all weed growth, and the soil should be well worked so as to retain moisture.

Custard apples will be coming forward in quantity, and the greatest care should be taken to see that they are properly graded and packed for the Southern markets, only one layer of one-sized fruit being packed in the special cases provided for this fruit—cases which permit of the packing of fruit ranging from 4 to 6 in. diameter in a single layer.

Slowly acting manures—such as meatworks manure—may be applied to orchards and vineyards during the month, and lime can be applied where necessary. Land intended for planting with pineapples or bananas during the coming spring can be got ready now as, in the case of pineapples, it is a good plan to allow the land to lie fallow and sweeten for some time before planting; and, in the case of bananas, scrub fallen now gets a good chance of drying thoroughly before it is fired in spring, a good burn being thus secured.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELAND.

CLEAN up all orchards and vineyards, destroy all weeds and rubbish likely to harbour fruit pests of any kind, and keep the surface of the soil well stirred, so as to give birds and predaceous insects every chance to destroy any fruit fly pupæ which may be harbouring in the soil. If this is done, many pests that would otherwise find shelter and thus be able to live through the winter will be exposed to both natural enemies and cold.

Further, it is a good plan to clean up the land before pruning takes place, as, if delayed till the pruning has been finished, the land is apt to dry out.

Pruning can be started on such varieties as have shed their leaves towards the end of the month, as it is a good plan to get this work through as early in the season as possible, instead of putting it off until spring. Early-pruned trees develop their buds better than those pruned late in the season. These remarks refer to trees—*not vines,* as the later vines are pruned in the season the better in the Granite Belt district, as late-pruned vines stand a better chance to escape injury by late spring frosts.

All worthless, badly diseased, or worn-out trees that are no longer profitable, and which are not worth working over, should be taken out now and burnt, as they are only a menace and a harbour for pests.

Land intended for planting should be be got ready as soon as possible, as, if ploughed up roughly and allowed to remain exposed to the winter frosts, it will become sweetened and the trees planted in it will come away much better than if set out in raw land. In any case the land must be properly prepared, for once the trees are planted it is a difficult matter to get the whole of the land as well worked as is possible prior to planting.

Slowly acting manures—such as ground island phosphates or basic phosphates—may be applied to orchards and vineyards. They are not easily washed out of the soil, and will become slowly available and thus ready for use of the trees or vines during their spring growth. Lime may also be applied where necessary.

This is a good time to attend to any drains—surface, cut-off, or underground. The two former should be cleaned out, and in the case of the latter all outlets should be examined to see that they are quite clear and that there is a good getaway for the drainage water. New drains may also be put in where required.

In the warmer parts citrus fruits will be ready for marketing, and lemons ready for cutting and curing. The same advice that has been given with respect to coast-grown fruit applies equally to that grown inland, and growers will find that careful handling of the fruit will pay them well. Lemons grown inland are, as a rule, of superior quality to those grown on the coast, but are apt to become too large if left too long on the trees, so it is advisable to cut and cure them as soon as they are ready. If this is done and they are properly handled they may be kept for months, and will be equal to any that are imported.

If the weather is very dry, citrus trees may require an irrigation, but, unless the trees are showing signs of distress, it is better to depend on the cultivation of the soil to retain the necessary moisture, as the application of water now is apt to cause the fruit to become soft and puffy, so that it will not keep or carry well.

Land intended for new orchards should be got ready at once, as it is advisable to plant fairly early in the season in order that the trees may become established before the weather again becomes hot and dry. If the ground is dry at the time of planting, set the trees in the usual manner and cover the roots with a little soil; then give them a good soaking; and, when the water has soaked into the soil, fill the hole with dry soil. This is much better than surface watering.

POINTS IN TOMATO CULTURE.

For the best results with tomatoes it is important that only seedlings that are strong and vigorous should be planted out. Careful experiments have demonstrated the marked influence of the early life of the plant on its subsequent behaviour. In view of this, and of the fact that most plant diseases are due to parasatic fungi, the following rules should be observed:—

Choose healthy seedlings. Practise crop rotation. Raise seedlings under a waterproof cover open to the north-east. Avoid over-watering of seedlings. Spray with Bordeaux mixture. Burn the crop residue at the end of the season. Plants grown on stakes and pruned are less liable to damage by diseases and pests.

Farm Notes

MAY.

FIELD.—May is usually a busy month with the farmer—more particularly the wheatgrower, with whom the final preparation of his land prior to sowing is the one important operation. Late-maturing varieties should be in the ground by the middle of the month at the latest.

Clover land, intended primarily for feeding off, should be sown not later than the end of April.

Seed wheat should be treated with copper carbonate for the control of bunt. For oats and barley seed the use of formalin or a reliable mercury dust is advisable.

Potatoes, which in many districts are still somewhat backward, should have by this time received their final cultivation and hilling-up.

The sowing of prairie grass on scrub areas may be continued, but should be finished this month. This is an excellent winter grass, and does well in many parts of Southern Queensland. Prairie grass seed should be treated with formalin or a reliable mercury dust before sowing.

Root crops, sowings of which were made during April, should now receive special attention in the matter of thinning out and keeping the soil surface well tilled to prevent undue evaporation of moisture.

Every effort should be made to secure sufficient supplies of fodder for stock during the winter, conserved either in the form of silage or hay.

Cotton crops are now fast approaching the final stages of harvesting. All consignments to the ginnery should be legibly branded with the owner's initials. In this matter the consignor is usually most careless, causing much delay and trouble in identifying parcels, which are frequently received minus the address labels.

A PROLIFIC SOW.

The following record of a litter of fourteen pigs from the Large White Sow, Strathmore Perfection, and sired by the Large White boar, Staghorn Bradbury 14th, owned by Mr. A. G. Stewart, Strathmore Stud Piggery, Cedar Pocket, Gympie, is considered a particularly good performance and possibly an Australian record for a litter at eight weeks old.

The litter consisted of fourteen pigs at birth and all were reared, but one pig (Tattoo No. 219) was so small at birth that it was taken from the sow when a day old and hand-reared.

The sow was fed on separated milk and meal during the suckling period, and the pigs, in addition to feeding at the trough with the sow, had access to a self-feeder containing a meal mixture in a creep away from the sow.

The birth weights and the weights at fifty-six days old were taken by officers of the Department of Agriculture and Stock. The intermediate weekly weighings were taken by Mr. Stewart.

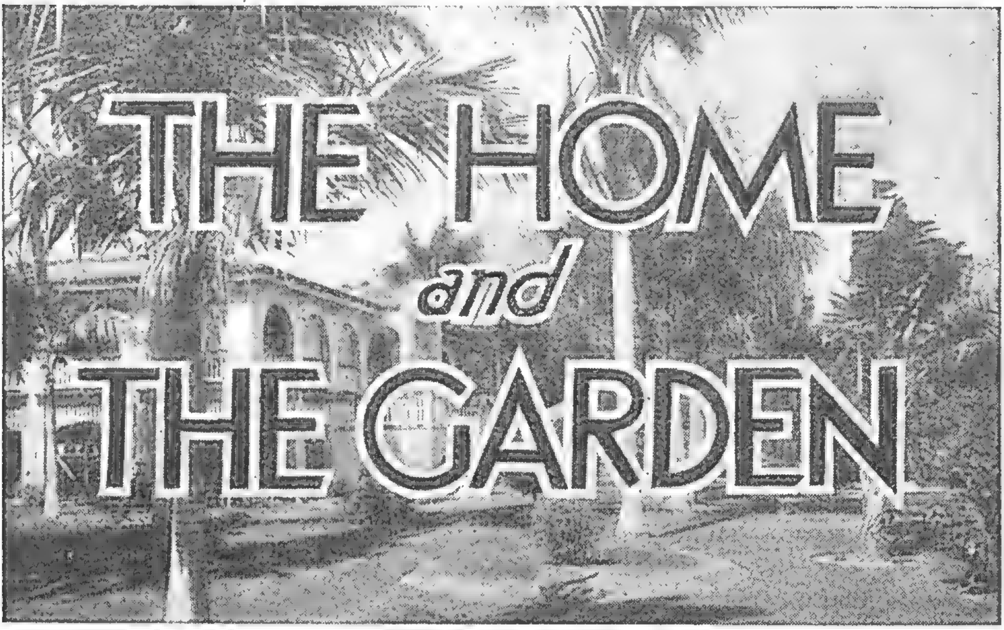
Owner: A. G. Stewart, Strathmore Stud, Cedar Pocket, Gympie.

Dam of Litter: Strathmore Perfection (Large White).

Sire of Litter: Staghorn Bradbury 14th (Large White).

Litter Born on: 11th December, 1936.

Tattoos or Earmarks.	209	210	211	212	213	214	215	216	217	218	219	220	221	222	Total.	Average.
Sexes	B	B	B	B	B	B	S	S	S	S	S	S	S	S	..	..
Weight at Birth–lb.	3	2½	3	3	2½	2½	2	3	3	3½	1½	2	3	3	37·5	2·6
Weight at 1 week	5	3½	5	5	4	4½	3	5	5	6	3	3½	5	4	61·5	4·3
Weight at 2 weeks	8	4	7½	6½	6	6	5½	8	7½	9	7	5	7	6	93·0	6·6
Weight at 3 weeks	13	7	11	9	10	10	8	11	11	13	12	7	11	10	143·0	10·2
Weight at 4 weeks	20	10	15	17	14	14	13	16	16	19	18	12	15	17	216·0	15·4
Weight at 5 weeks	26	15	22	20	19	20	18	22	22	25	25	17	27	24	302·0	21·5
Weight at 6 weeks	33	21	29	25	22	28	29	30	29	33	32	23	30	30	394·0	28·1
Weight at 7 weeks	42	26	39	33	30	32	32	36	33	41	39	29	36	35	483·0	34·5
Weight at 8 weeks	51	36	43	41	33	40	38	42	39	47	49	36	44	44	583·0	41·6



OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

WHY IS MY CHILD NAUGHTY?

THE following talk to mothers is taken from the "Mother and Child" journal.

"If your child is naughty, if he is selfish, if he 'shows off,' it may not be altogether his fault. Perhaps you have made him like this. All children are naughty at times, of course, but where naughtiness has become a habit instead of an occasional lapse there is reason to suspect that all may not be well in the parents' attitude to the child, and parents who honestly desire their child's well-being and contentment will ask themselves some heart-searching questions such as these:—Are you nicer to one child than to another? Do you laugh at your child sometimes when he is naughty and sometimes when he is good? No wonder he is puzzled! How can he possibly know what to do in order to please his parents? Is your attitude consistent, that is, can your child understand your attitude to right and wrong? Do you punish the children when you are angry? The story is told of a mother who was punishing her little boy very severely, when a friend asked her whether it did the child any good to be smacked so hard. The mother answered, "Perhaps it doesn't do him any good, but it does me lots of good." Children know when they are being punished unfairly, and unjust punishment will only make them more difficult than ever to manage. Do you punish your children too severely? If you do this they will tell lies to avoid being punished.

"Are you always truthful yourself, both in what you say and what you do?

"Supposing a friend telephones and asks you, for example, to go to the pictures with her, and your boy answers the telephone. Do you say to him, 'I don't want to go. Tell her I have a headache'? Can you wonder if the next morning your boy 'has a headache' when it is time for him to go to school?

"Are you letting your little child grow up and begin to be independent of you, or are you trying to keep him a baby? We cannot blame parents for being rather sad when they see their baby growing out of babyhood, but it is a very bad policy to try to hold back the child's growth, to try to force him to remain a baby by doing everything for him, and talking to him in 'baby talk.' Children want to do things for themselves, and if they are not allowed to try they very often become naughty. They love to 'help,' and though their efforts may be very clumsy at first they should be encouraged in spite of accidents. Some parents, when they see a broken cup or something spilled on the floor, scold the child and refuse to let him help. The child learns that it is safer for him not to help. Later on, when his parents want him to be useful and helpful, he will refuse, and he will be blamed for selfishness and laziness. But who taught him to be selfish and lazy?

"Do you talk about your child before him? Many parents do this. They think that the child is too young to understand, that he is not paying attention, or else they do not think at all. But very little children—even babies—do pay attention, and they do understand. They may not understand your words, perhaps, but they understand your voice and your face. They know when you are talking about them. If you allow your little child to hear you say to a friend, 'No, I can't go so early because Johnny cries if I don't sit with him until he goes to sleep,' you have taught him that he has only to cry and you will obey him. If you remark at breakfast, 'Father, can you make Johnny eat his porridge? I can't,' Johnny understands that he has only to say, 'I won't,' and you are helpless. If you allow a child to hear you say again and again, in his presence, that you cannot make him obey it is hardly a wonder if he becomes disobedient.

"Another point—when he is within hearing do you describe to your friends your little child's amusing and clever sayings and doings? That is the way to turn him into a 'show off,' wanting attention all the time. It is natural, of course, for parents to talk about their child's ways and laugh together over the funny little remarks he makes, but they should keep this pleasure until the child is out of earshot.

"Disagreement between the parents on some point of management, in the child's presence, is another frequent cause of disobedience. If mother forbids him to go out to play and father, more easy going, says, 'Oh, let him go! Why shouldn't he?' the child naturally feels that he need not obey his mother. Parents who are eager to be good parents will never let each other down in this way. If one thinks the other has made a mistake they will talk it over when the child cannot hear them."

IN THE FARM KITCHEN.

POULTRY DISHES.

Chicken Loaf.

Take 2 cupfuls chopped cooked chicken, 1 cupful breadcrumbs, 1½ tablespoonfuls butter, ½ cupful milk, ½ cupful pea puree, 2 eggs, 1 onion, salt, pepper, paprika.

Slice and fry the onion. Place crumbs in a basin and pour over the heated milk. Rub enough cooked or tinned peas through a sieve to give you the quantity of puree required, then mix all ingredients together, and season to taste. Place in a baking dish which has been well greased. Bake in a moderate oven till firm and brown. Serve hot or cold. If cold, garnish with sliced tomato and serve with potato salad.

Chicken Mousse.

Take 1 cupful white chicken meat, 3 egg-yolks, 1 cupful whipped cream, ½ cupful heated chicken jelly, 1½ cupfuls milk, 1 dessertspoonful gelatine, lettuce-leaves, tomatoes.

Beat the egg-yolks. Add the milk. Cook mixture in the top of a double boiler until like custard. Cool and add chopped white chicken meat. Soak gelatine in the hot chicken jelly and dissolve, season custard to taste with salt, pepper, and paprika, and add chicken jelly and gelatine. Whip cream until thick, measure, then gradually fold into mixture, when beginning to set. Turn into a round mould rinsed out with cold water. When set turn out into a glass dish lined with lettuce leaves. Garnish with quarters of tomatoes.

Chicken Canapes.

Take 1 large cucumber, chicken, capers, tomatoes, mayonnaise, mustard, and cress, or parsley.

Peel cucumber. Cut into thick slices, scoop out centre with a cutter which is large enough to remove all but the rim. Place each cucumber ring on a thick slice of tomato, then fill rings with cold chopped breast of chicken, moistened with mayonnaise. Decorate each with minced capers, parsley, or mustard and cress.

Chicken Croquettes.

Take 2 cupfuls chopped cooked chicken, 1 cupful white sauce, ¼ teasponful onion juice, ½ teaspoonful salt, cayenne, 1 teaspoonful lemon juice, 1 egg, 1 teaspoonful chopped parsley, breadcrumbs.

Chop the chicken finely. Season to taste with cayenne and salt, lemon juice, onion juice, and parsley. Add white sauce, mix well together, shape into croquettes. Roll in crumbs, then in beaten egg and crumbs again. Fry in deep, smoking fat till crisp and brown.

Giblet Pie.

Take 2 sets poultry giblets, 1 small onion, 6 peppercorns, 1 egg, 1 lb. rump steak, sprig parsley, 1 lb. flaky pastry, cold water.

Prepare, clean, and wash giblets, and place them in a saucepan. Add peeled onion, six peppercorns, and a sprig of parsley. Cover with cold water. Bring to the boil. Add a pinch of salt, then skim. Cover and simmer gently for two hours. Then remove and allow to cool. Line the bottom of a buttered pie-dish with steak cut into small pieces, and dipped in seasoned flour. Cover with chopped giblets, and then another layer of seasoned steak. Add the giblet stock, and season highly. Cover pie-dish with pastry in the usual way. Decorate with pastry leaves and brush top with beaten egg. Bake in a quick oven for one and a-half hours.

Chicken Roly Poly.

Take 2 cupfuls minced chicken, 2 onions, 2 teaspoonfuls salt (scant), ½ cupful chopped fried bacon, 4 tablespoonfuls minced parsley, ½ teaspoonful pepper, 4 cupfuls sifted flour, 4 teaspoonfuls baking powder, 4 oz. butter, stock, about 1 cupful water.

Sift the flour with baking powder and one teaspoonful of the salt. Rub in the butter with the tips of fingers. Mix to a dough with the water. Turn on to a floured board. Divide into two portions. Roll each out to ¼ inch thick. Meanwhile, place chicken in a basin with the onions grated, finely-chopped parsley, diced bacon, and remainder of salt and pepper. Mix well. Moisten with stock or giblet gravy. Spread on pastry. Roll and press ends of pastry firmly together. Place on a well-greased baking-tin and bake for thirty-five minutes in a moderate oven.

Blanquette of Chicken.

Take 1 lb. cold chicken, ¼ lb. tongue, 1 pint white sauce, juice ½ lemon, 1 gill stock, salt, and pepper.

Place white stock in a saucepan. Stir in sauce and mix well. Add chopped chicken and the tongue cut into dice. Season to taste with salt and pepper, and add strained lemon juice. Place pan over the gas and stir until mixture is thoroughly hot. Turn on to a hot dish and serve at once with mashed potatoes.

Chicken Cream Moulds.

Take 1 tablespoonful gelatine, ¼ cupful cold chicken stock, ¾ cupful hot chicken stock, 1 cupful cold cooked chicken, 1 cupful thick cream, salt and pepper to taste, lettuce.

Soak the gelatine in the cold stock, then dissolve in the hot stock, well seasoned and strained. When mixture begins to thicken beat until it is frothy. Then add whipped cream and chicken cut into dice. Season with salt and pepper, and pour into individual moulds. Serve on a bed of lettuce leaves, and garnish with slices of hard-boiled egg.

Chicken Salad.

Take ½ pint diced cooked chicken, 1 tablespoonful lemon juice, ½ cupful diced celery, ½ cupful mayonnaise, chopped stuffed olives, lettuce, capers, salt and pepper.

Dice the chicken and mix with lemon juice, celery, and seasoning to taste. Toss in mayonnaise and serve in a bed of lettuce, and leave arranged on a pretty dish. Garnish with chopped stuffed olives and capers.

Timbale of Spaghetti and Chicken Livers.

Take 4 oz. spaghetti, 2 chicken livers, 2 tablespoonfuls grated cheese, 2 tomatoes, pepper, salt, margarine for frying.

Boil the spaghetti in salted water for twenty minutes. Fry the chicken livers and cut into small pieces. Fry the tomatoes until soft, and press them through a sieve. Mix all together, and add grated cheese, pepper and saft to taste. Stir the mixture thoroughly, and place in a timbale or ordinary casserole. Cook in a moderate oven from twenty-five to thirty minutes. Serve very hot.

Rissotto of Chicken.

Take 1 cupful cooked chicken (chopped), 1 onion, ¾ cupful rice, 1 quart chicken broth, 2 tablespoonfuls butter, grated cheese.

Melt the butter in a saucepan. Fry onion without browning it. Add chicken broth. Bring to boil, then wash and add rice. Cover saucepan. Simmer for about twenty-five minutes, shaking the pan occasionally to prevent rice sticking. Don't stir unless absolutely necessary. When ready the rice should have absorbed nearly all the broth, and the grains should be swollen and separate. Add chicken, stir for a moment or two, then turn on to a hot dish. Sprinkle thickly with grated cheese and serve at once.

DEFECTS IN DAIRY UTENSILS.

No farmer has to use tinware of various descriptions to the same extent as the dairyman, and an elementary knowledge of the use of the soldering iron is of particular value in his case. In fact, it might almost be considered a necessary part of a dairy farmer's training. The mending of leaks, the retinning of rust spots, the refixing of milk-can hoops, &c., are all jobs that are possible to a man determined to master a few essentials of the process.

It is the continuous neglect of the rough places in tinware that has such a serious effect on milk and cream quality, by affording lodging places for decaying milk and cream. The exposed metal is also attacked by the acid in the cream, and this is responsible for some of the flavour defects in butter. A few drops of solder will quickly rectify these tinware faults.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF FEBRUARY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Feb. 1936.	No. of Years' Records.	Feb. 1937.	Feb. 1936.
North Coast.	In.		In.	In.
Atherton	10·65	36	12·17	15·18
Cairns	15·95	55	4·90	29·57
Cardwell	17·16	65	6·63	51·31
Cooktown	13·79	61	9·24	22·61
Herberton	7·95	51	9·64	10·43
Ingham	16·43	45	6·32	41·74
Innisfail	22·92	56	7·30	53·89
Mossman Mill	18·38	24	20·64	29·15
Townsville	11·26	66	4·70	28·70
Central Coast.				
Ayr	9·20	50	..	28·61
Bowen	8·78	56	5·76	16·67
Charters Towers	..	..	3·82	7·66
Mackay	11·72	66	15·38	8·78
Proserpine	12·69	34	6·08	29·98
St. Lawrence	7·74	66	9·55	5·30
South Coast.				
Biggenden	4·40	38	3·17	1·59
Bundaberg	6·54	54	6·06	1·27
Brisbane	6·41	85	5·25	1·27
Caboolture	7·79	50	6·53	1·61
Childers	6·74	42	4·72	1·92
Crohamhurst	12·89	44	9·37	2·09
Esk	5·48	50	2·15	2·05
Gayndah	4·24	66	1·77	0·87
Gympie	6·80	67	6·49	2·00
Kilkivan	4·93	58	4·09	1·67
Maryborough	6·81	66	6·59	2·46
Nambour	9·74	41	7·82	3·30
Nanango	4·09	55	1·72	1·64
Rockhampton	7·71	56	10·63	4·69
Woodford	8·45	50	7·48	0·85
Central Highlands.	In.		In.	In.
Clermont	4·19	66	3·58	2·42
Gindie	2·70	38	4·60	0·38
Springsure	3·83	62	4·33	0·93
Darling Downs.				
Dalby	2·83	67	1·04	0·61
Emu Vale	2·53	41	2·32	0·28
Hermitage	2·42	31	..	0·56
Jimbour	2·63	49	1·33	0·45
Miles	2·69	52	3·08	1·64
Stanthorpe	3·16	64	2·36	..
Toowoomba	4·53	65	2·96	1·47
Warwick	3·05	72	0·89	0·91
Maranoa.				
Roma	2·89	63	3·75	1·72
State Farms, &c.				
Bungeworgorai	..	..	..	2·99
Gatton College	3·56	38	..	2·03
Kairi	9·99	21	..	18·84
Mackay Sugar Experiment Station	10·91	40	22·77	27·21

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—FEBRUARY, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Means at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·77	90	75	95	13, 17, 18, 19	72	2, 3	924	16
Herberton	..	83	64	86	21, 22, 23	59	2, 13	964	15
Rockhampton	29·84	87	72	98	23	68	18, 19, 27	1063	12
Brisbane	29·97	84	68	92	22	63	1, 20, 27	127	15
Darling Downs.									
Dalby	29·91	87	63	98	21, 22	55	20	104	8
Stanthorpe	..	77	57	89	9	44	23	236	15
Toowoomba	..	..	60	93	21, 22	52	17	296	11
Mid-Interior.									
Georgetown	29·80	92	71	99	12	63	13	473	9
Longreach	29·80	97	71	109	2	64	12	431	8
Mitchell	29·88	86	65	98	1	55	24	453	6
Western									
Burketown	29·77	95	77	103	12	69	6	180	8
Boulia	29·77	101	75	108	1, 2, 3, 4	69	7	77	1
Thargomindah	29·81	94	72	105	1, 2	65	11, 12, 13, 23, 24	87	4

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	April. 1937.		May. 1937.		MOONRISE. April. 1937.	MOONRISE. May. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6·2	5·50	6.18	5·20	9·2	9.39
2	6·3	5·49	6·18	5·19	9·52	10·29
3	6·3	5·48	6·19	5·18	10·44	11·24
4	6·4	5·46	6·20	5·17	11·41	..
					a.m.	a.m.
5	6·4	5·45	6·20	5·17	..	12·22
6	6·5	5·44	6·21	5·16	12·37	1.20
7	6·5	5·43	6·21	5·15	1·35	2·20
8	6·6	5·42	6·22	5·14	2·36	3·23
9	6·6	5·41	6·23	5·14	3·38	4·31
10	6·7	5·40	6·23	5·13	4·40	5·39
11	6·7	5·39	6·24	5·12	5·49	6·50
12	6·8	5·38	6·24	5·11	6·56	7·59
13	6·8	5·37	6·25	5·11	8·6	9·3
14	6·9	5·36	6·26	5·10	9·14	10·3
15	6·9	5·35	6·26	5·10	10·19	10·47
16	6·10	5·34	6·27	5·9	11·17	11·31
					p.m.	p.m.
17	6·10	5·34	6·27	5·9	12·10	12·10
18	6·11	5·33	6·28	5·8	12·53	12·45
19	6·11	5·32	6·29	5·8	1·33	1·18
20	6·12	5·31	6·29	5·7	2·9	1·50
21	6·12	5·30	6 30	5·7	2·43	2·23
22	6·13	5·29	9·31	5·6	3·16	2·58
23	6·13	5·28	6·31	5·6	3·50	3·36
24	6·14	5·26	6·32	5·5	4·21	4·14
25	6·14	5·25	6·32	5·5	4·54	4 56
26	6·15	5·24	6·33	5·4	5·34	5·44
27	6·15	5·24	6·34	5·4	6·14	6·34
28	6·16	5·23	6.34	5·3	6.59	7·27
29	6·16	5·22	6·35	5·3	7·46	8·23
30	6·17	5·21	6·35	5·2	8·38	9·19
31			6·36	5·2		10·15

Phases of the Moon, Occultations, &c.

4 Apr.	☽	Last Quarter	1 53 p.m.
11 ,,	●	New Moon	3 10 p.m.
18 ,,	☾	First Quarter	6 34 a.m.
26 ,,	○	Full Moon	1 23 a.m.

Perigee, 12th April, at 6 p.m.
Apogee, 27th April, at 8 p.m.

Mercury rises at 6.33 a.m., 31 minutes after the Sun, and sets at 6.11 p.m., 21 minutes after it on the 1st; on the 15th it rises at 7.37 a.m., 1 hour 28 minutes after the Sun, and sets at 6.27 p.m., 52 minutes after it.

Venus rises at 7.59 a.m., 1 hour 57 minutes after the Sun, and sets at 6.37 p.m., 1 hour 37 minutes after it on the 1st; on the 15th it rises at 6.35 a.m., 26 minutes before the Sun, and sets at 5.27 p.m., 8 minutes before it.

Mars rises at 8.39 p.m. and sets at 10.15 a.m. on the 1st; on the 15th it rises at 7.47 p.m. and sets at 9.25 a.m.

Jupiter rises at 12.10 a.m. and sets at 1.52 p.m. on the 1st; on the 15th it rises at 11.28 p.m. and sets at 1.3 a.m.

Saturn rises at 5.0 a.m. and sets at 5.17 p.m. on the 1st; on the 15th it rises at 4.22 a.m. and sets at 4.18 p.m.

In the months of March and April of every recurring year our evening sky is resplendent with the most brilliant of both the northern and southern constellations. When about 7 o'clock in the beginning of March Orion had reached its greatest altitude one could trace from this, the finest of all constellations, as in a great round, to the eastward, Canis Major with the wonderful Sirius, lower down Canis Minor with the deep orange-coloured Procyon, and lower still the conspicuous white stars Castor and Pollux in Gemini, and below Orion, nearest the horizon, the fine first magnitude star Capella in the great five-cornered constellation Auriga; then, upward to the north-west, the Pleiades and, nearest Orion, the Hyades—all these, though not quite so favourably placed as in February.

In April, when the enormous length of the good ship Argo with its one bright light Canopus lies westward of the Southern Cross, the whole of the Centaur, eastward of it, has arisen—of which only the Pointers were visible in March—with its great disk of beautifully grouped stars of nearly the same magnitude. And now, when Orion is nearing the horizon in the west, the Scorpion arises in the east, a rival in grace and beauty if not in brilliancy.

4th May.	☽	Last Quarter	4 36 a.m.
10th ,,	●	New Moon	11 17 p.m.
17th ,,	☾	First Quarter	4 49 p.m.
25th ,,	○	Full Moon	5 38 p.m.

Perigee, 11th May, at 4 a.m.
Apogee, 24th May, at 11 p.m.

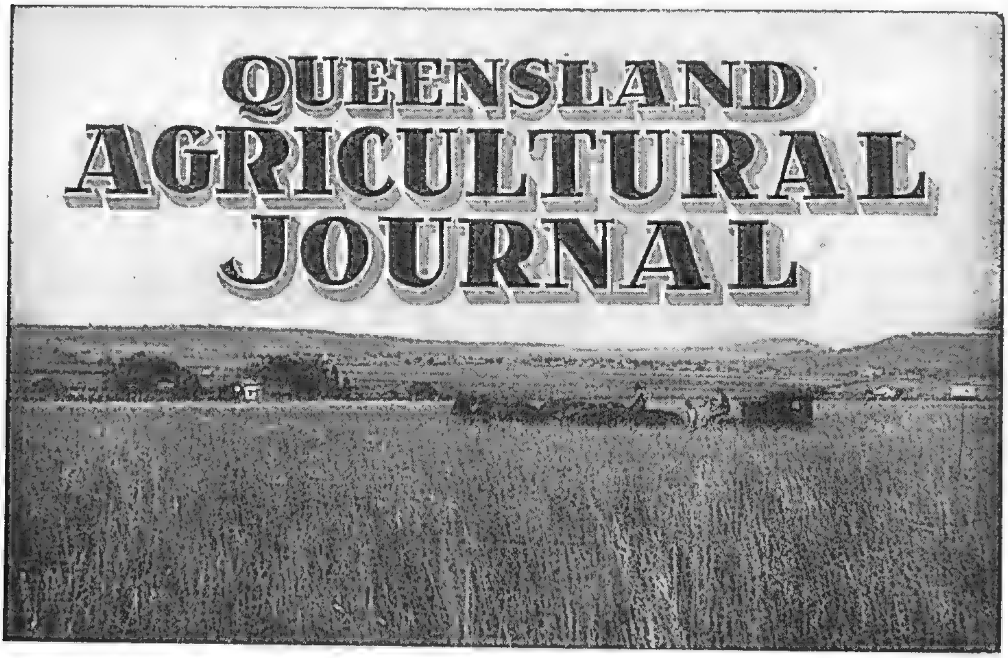
For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten shillings,** including postage.



VOL. XLVIII. 1 MAY, 1937. PART 5

Event and Comment

Anzac.

THROUGHOUT the Commonwealth the Anzac Anniversary was observed with appropriate ceremony. At first regarded as an exploit, the landing on Gallipoli on Sunday, 25th April, 1915, has grown into a great and glowing tradition—a tradition shared by Australians and New Zealanders with the other forces of the Empire that took part in the hazardous adventure. How a position—an impossible position according to all the text-books of war—was held through eight long months of continuous fighting is now history. The men who made that history established a standard of courage, fortitude and devotion that inspired every Australian who fought in the later campaigns.

The spirit of Anzac, however, means something more than the mere exaltation of physical courage and other qualities that go with it. It typifies all the master virtues embodied in the highest ideals, the striving after which endows a nation with soul and character. Of the men by whose invincible valour and conquest of circumstance a standard was set and an ideal created, what more can be said? These beautiful lines of Alexander William Mair's "In Memoriam" give the answer:—

Though of their glory all the earth is haven,
And though their grave is under every sky,
Here lies their youth; here let their name be graven,
Who, dying, taught men how to die . . . . . .

Grave then their name, that so their name engraven
Shall be remembered to the end of days,
Who won in home or alien soil their haven—
For tomb an altar and for pity praise.

Agricultural Organisation.

"QUEENSLAND is destined to become the greatest agricultural State in the Commonwealth," said the Minister for Agriculture and Stock, Mr. Frank W. Bulcock, in the course of a recent radio address on "The March of Agriculture." To fulfil this destiny, he added, it was necessary to develop together the cultural, scientific, and economic sides of the agricultural and pastoral industries.

In its endeavour to serve the producers in each of these phases the Queensland Department of Agriculture had taken a leading part. On the cultural side the departmental officers were in intimate touch with the producers, seeking to be their counsellor and friend, giving immediate service in emergencies.

One of the present Premier's (Mr. W. Forgan Smith) finest achievements was his establishment of the Chair of Agriculture in the University of Queensland, which was a very important influence in the progress of the science and practice of agriculture in this State.

Queensland had, in some matters, commodity marketing particularly, given a lead to the world in rural economic policy, Mr. Bulcock continued. The commodity pool organisation, of which the Premier and the late Mr. W. N. Gillies were the fathers, had given the farmers control of their products from the farm to the consumer. Because of this organisation the cost of living in Queensland was lower than in any other Australian State, yet the farmers were better off as a whole than farmers anywhere else in the Commonwealth. The Commonwealth rural debts investigation disclosed that the debt per farmer was less in Queensland than in any other State. This was because the pool organisation kept the Queensland producers out of the depths of the depression.

In all branches of its work, cultural, scientific, and economic, Mr. Bulcock concluded, his department was anxious and happy to co-operate with the man on the land in dealing with the problems with which every primary producer, at one time or another, was confronted.

Subsidised Juvenile Rural Employment Scheme—An Appeal to Farmers.

TO encourage unemployed city boys to accept farm jobs in the country, it is proposed to subsidise the wages paid in certain cases. The usual wage paid to the inexperienced farm lad is 10s. a week, which is increased, as a rule, to 12s. 6d. a week at the end of six months if the lad shows satisfactory progress in farm work. It is not proposed to alter this ruling wage as paid by the farmer, but to subsidise it from Unemployment Relief Funds by such an amount as will raise the total wage to 17s. 6d. in the case of the lad 16 to 18 years of age, and to £1 per week if he is 18 to 21 years of age. This subsidy will be paid only to inexperienced or partly experienced lads (those who have not had more than six months' farming experience) of these age groups.

No subsidy will be paid in the case of the lad who has had more than twelve months' experience on a farm. It is also stipulated that a "son or relative residing with a farmer cannot be allotted to that

farmer.'' The farmer will be required to pay his proportion of the wages not less frequently than fortnightly; the subsidy will be paid direct to the lad by cheque posted monthly.

For the convenience of farmers who wish to employ lads under the scheme, advantage is being taken of the State school organisation. Farmers should apply to the local school for the necessary forms.

In making the foregoing announcement, the Minister for Labour and Industry, Mr. M. P. Hynes, stated that the scheme represented a further effort on the part of the Government to encourage the unemployed youth in the city to take up farm work. According to the Council of Agriculture there is a great scarcity of juvenile labour in the country and this scarcity of juvenile farm labour has been used as an argument in favour of the resumption of assisted immigration. ''I refuse to think of that,'' said Mr. Hynes, ''as long as our own boys are unemployed. A demand for their labour exists in the country. Surely we can discover the root causes of their objection to farm work, and endeavour to remove them. That is the main purpose of this scheme. We are attempting to meet what I believe has been the main objection in the past—the low wages offered. The scheme is an experiment and its application is, therefore, limited, but we shall review it after it has been in operation for twelve months, and extend it or amend it in the light of our experience.

''I am appealing to every section of the community to help to make the scheme successful. I appeal to parents, especially to mothers, to encourage their lads, if they are unemployed, to at least give the scheme a trial. Every job will be carefully investigated before it is approved. Parents can rest assured, therefore, that their boys will go to good homes. I am appealing also to farmers. They can do much to remove the prejudice against farm work which, without a doubt, exists in the minds of city dwellers. The great majority of farmers are good employers, but there is an occasional bad employer who is a hard taskmaster, and he is responsible for this prejudice. I would ask farmers to think what the change from city to country conditions must mean to the lad who is probably leaving home for the first time. I ask them to make allowances, to be understanding, considerate, and encouraging. The city lad will, as a rule, respond to such sympathetic treatment, and will settle down to farm life and develop into a competent, capable farm worker.''

In Brisbane, boys seeking employment under the scheme should register at the Rural Section of the Juvenile Employment Bureau in the Treasury Buildings (hours 10 a.m. to 1 p.m. and 2 p.m. to 4 p.m. daily). In country centres registrations may be lodged at the local technical college or at the local State school, where the necessary forms are now available Where it is inconvenient to register locally, applications for registration may be posted direct to the Chairman, Board of Juvenile Employment, Box 1438T, G.P.O., Brisbane.

Plate 160.
THEIR MAJESTIES KING GEORGE VI. AND QUEEN ELIZABETH.

Plate 161.

THE KING AND QUEEN AT GOVERNMENT HOUSE, BRISBANE.—Group taken when Their Majesties, then Duke and Duchess of York, were visiting Queensland in April, 1927.

Seated (left to right).—The Countess of Cavan; Mrs. W. Forgan Smith; Queen Elizabeth; Mrs. W. Lennon; The Hon. Mrs. J. Little-Gilmour.

Standing (left to right).—Mr. H. F. Batterbee, C.M.G., C.V.O.; Lt. Commander Buist, R.N.; Hon. W. Forgan Smith, LL.D., Premier of Queensland; The King; Hon. W. Lennon (then Lieutenant-Governor); General The Earl of Cavan, K.P., G.C.B., G.C.M.G., G.C.V.O.; Mr. P. K. Hodgson, C.M.G., O.B.E.; Major T. E. G. Nugent, M.C.

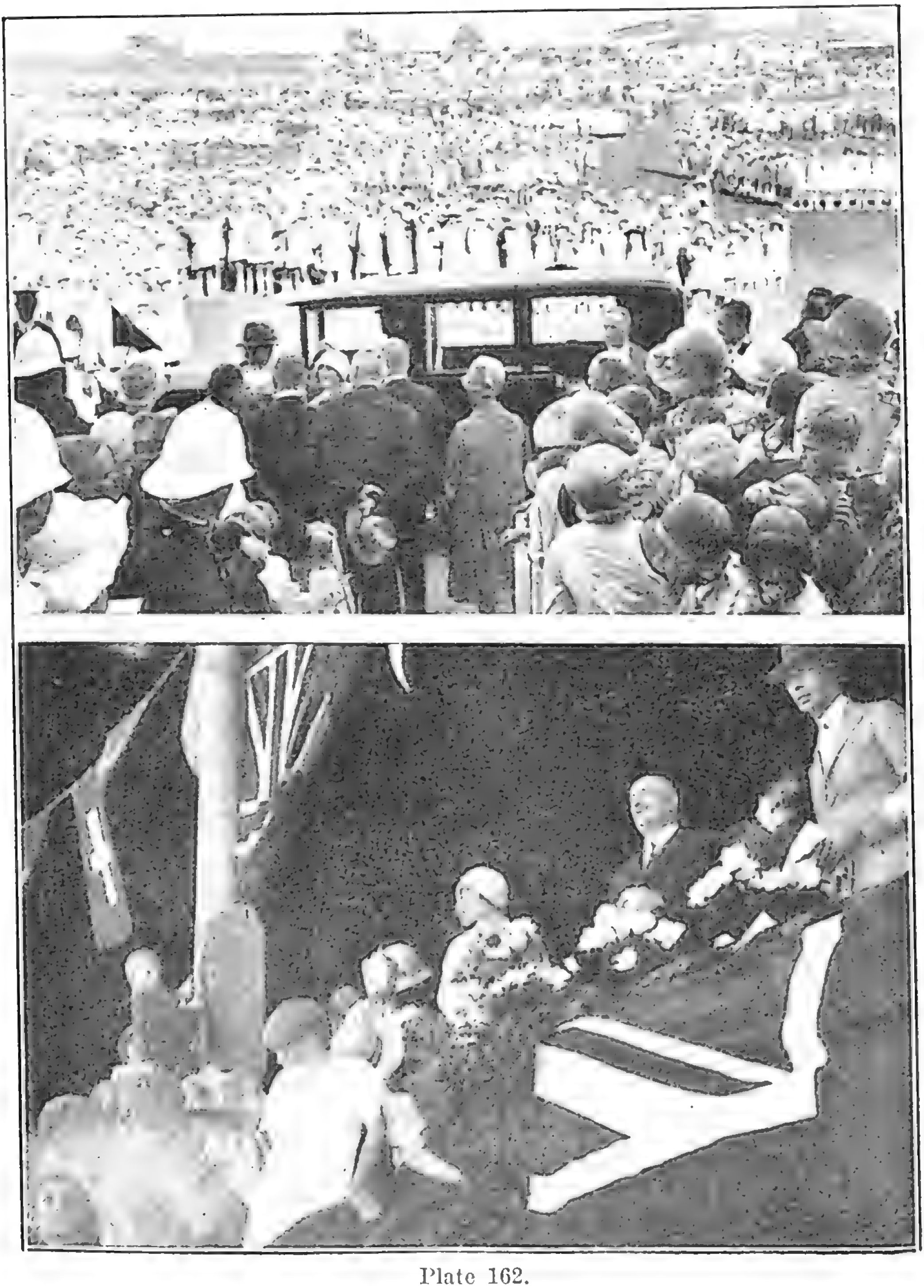


Plate 162.

WHEN THE KING AND QUEEN VISITED BRISBANE, APRIL, 1927.—Children's Display at the Exhibition Ground.

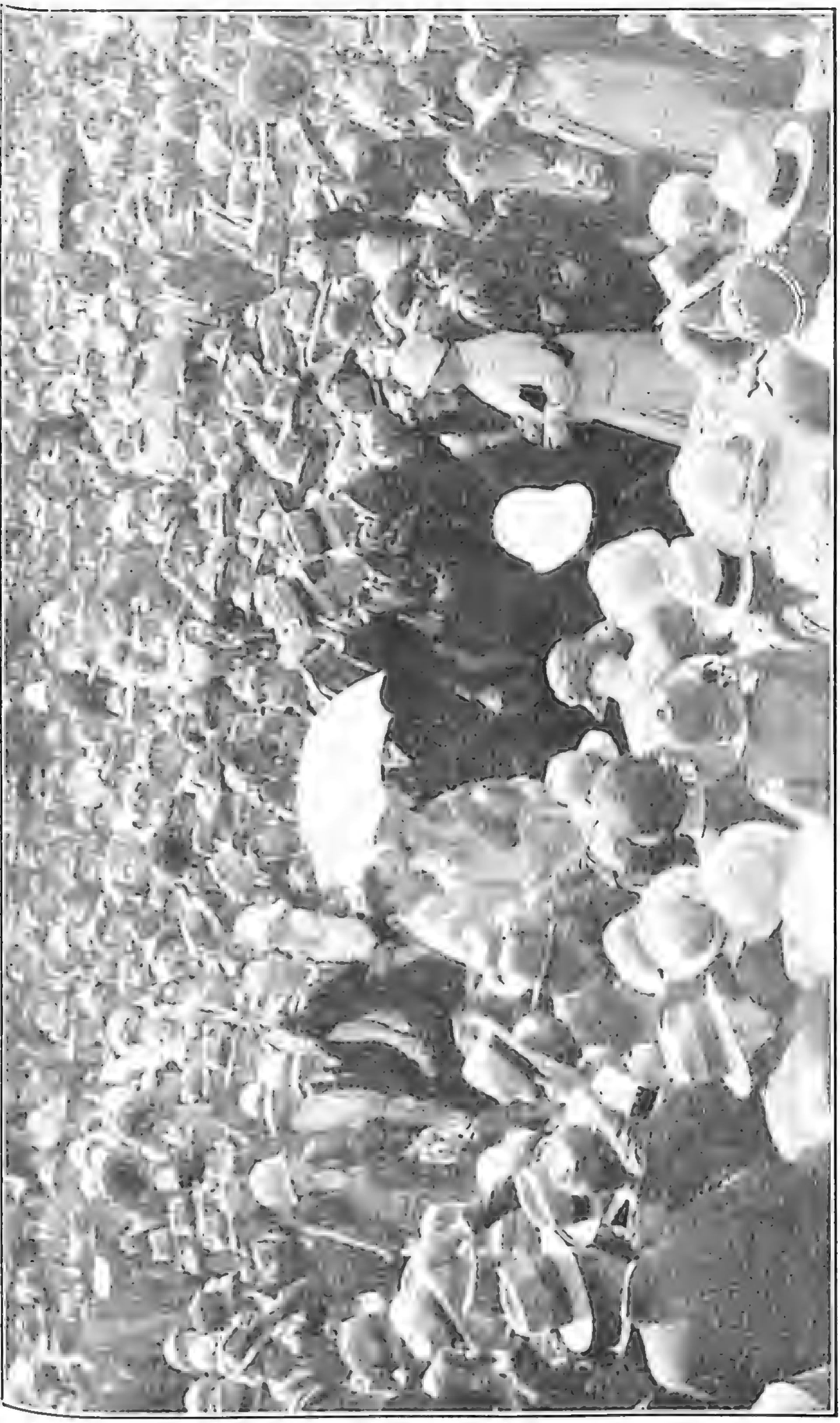


Plate 163.
Their Majesties Greeting Country People at the Beaudesert Show, 1927.

Plate 164.

IN QUEENSLAND CATTLE COUNTRY.—The King and Queen were keenly interested in the Camp Drafting at Beaudesert (9th April, 1927).

The Grasshopper Outbreak in Queensland.

1934-35.

J. A. WEDDELL, Entomologist.

[*Continued from p. 364, Part IV., Vol. XLVII.—April,* 1937.]

SECTION III.

CONTROL.

In the early stages of the outbreak control recommendations that would be economical and practical and would use readily available material had to be rapidly formulated. In the choice of an insecticide, the points to be decided were, firstly, whether a spray or a poison bait would be more suitable, and, secondly, which of the arsenicals would be most useful for the purpose. Experimental trials to elucidate these points were therefore carried out. The formulæ used in both the baiting and spraying trials were, of course, modelled very closely on those that are standard for the control of grasshoppers in other Australian States and in other parts of the world.

Baiting Trials.

At the moment limited quantities of several arsenicals were available, and small-scale tests were carried out. Accordingly, adjacent plots were pegged within the boundaries of a fairly large hopper swarm that was commencing to invade a wheatfield in which the plants were about 1 foot in height. Each plot included a section of grassed roadway, a strip of headland, and a portion of infested wheat. The various bait mixtures that were provisionally listed for trial were measured out in the following quantities:—

Bait No. 1—1¼ oz. white arsenic
2½ lb. bran

Bait No. 2—½ oz. sodium arsenite
2½ lb. bran

Bait No. 3—1 oz. arsenic pentoxide
2½ lb. bran

Bait No. 4—½ oz. sodium arsenite
2½ lb. wheatmeal

Bait No. 5—1 oz. arsenic pentoxide
2½ lb. wheatmeal

Bait No. 6—1 oz. arsenic pentoxide
½ lb. molasses
2½ lb. bran

Wheatmeal was included in the trials, as a plentiful supply was available in the Kooroongarra area. As anticipated, the wheatmeal became a doughy mass on wetting and proved quite unsuitable for broadcast distribution. Mixtures No. 4 and 5 were therefore rejected.

Baits Nos. 1, 2, 3, and 6 were applied and adjacent areas were regarded as controls. The materials were broadcast, perforce, at 5.0 p.m. on 20th September, 1934—a rather unsuitable hour for the purpose. Almost twenty-hours elapsed before results commenced to show, but by 8.0 a.m. on 22nd September the kill on all plots was very satisfactory.

[Photo. N. A. R. Pollock.

Plate 165.

A small portion of a heavy accumulation of dead hoppers in a gutter in a road cutting, following normal baiting.

Quantitative results were not possible, but careful observations failed to show any marked difference in the toxicity of the baits. However, an examination of surplus baiting materials indicated that the mixture containing the molasses remained sticky for a longer period than the others. In later baiting work the quantity of molasses present appeared to have a marked effect on the durability of attraction of the baits, particularly in dry weather.

Larger areas were then laid down with a slightly modified bait mixture which was finally standardised by empirical methods, as follows:—

½ lb. arsenic pentoxide
4 lb. molasses
2½ gallons water
24 lb. bran

Applications of this bait were made on various types of infested country, including bare ground, pasturage, in rough gullies containing dense weeds and tufty grass, and in wheat and other crops. On bare ground and in the presence of relatively sparse feed the kill was practically 100 per cent. Where succulent feed was available, some survivors persisted, but the swarms were definitely broken up and reduced to harmless numbers. Even swarms invading young wheat having 6 inches of growth were represented only by a few living stragglers, the remainder forming a fairly dense layer of dead on the ground.

Scavenging insects, particularly the meat ant *Iridomyrmex detectus* Sm., reaped a harvest among the dead. From baited areas there were continuous streams of ants, each carrying a young dead hopper. Nests were seen that were literally covered by the garnered dead.

In a baited area very heavy accumulations of dead were generally found at the bases of posts, trees, logs, &c., within the area, beneath weeds, and among grass tufts and in small depressions. Apparently, poisoned but still surviving hoppers climbed as usual at dusk, but the lethal effects of the bait took effect during the night. The dead hoppers fell to the ground, accumulating in heaps. Similarly, poisoned hoppers that fell or were blown into cracks and holes in the ground were unable to escape. As a consequence, many of the baiting results were very spectacular. (Plate 165.)

During the course of several baiting trials at Kooroongarra it was found during the spring weather that the most satisfactory results followed the applications made between 10 a.m. and 3 p.m. The nights were cold, mornings and evenings were noticeably cool, and the hoppers did not show any marked activity until about 9 a.m.

For the swarm of average density, satisfactory results were obtained when the bait used per acre contained about 1½ bushels of dry bran. Actually, an area approximately 48 yards long and 6 yards wide was baited with 2 lb. dry weight of bran—a fairly close approximation to the average dosage. Following a good kill of hoppers on this area, some particles of bran still remained on the ground.

In practice, the best method of dealing with a particular swarm was first to determine roughly its dimensions and boundaries, making note of any guide marks such as logs or stones, or even, if necessary, inserting pegs. The broadcasting of the bait could then be carried out

by traversing the area in a regular manner up and down as in sowing grain, and an adequate space beyond the swarm could also be baited. Without some such indicators or guides, it was easy, on the one hand, to miss portion of a swarm in baiting, or, on the other, to waste materials by double baiting or by working further beyond the swarm than was necessary.

With swarms of young hoppers the treatment of the area occupied and of an uninfested strip 10 feet wide beyond the swarm was sufficient, but when the hoppers were older experience showed that the extra marginal strip could be increased up to 30 feet wide with advantage.

Towards the end of the outbreak a trial was made substituting pinewood sawdust for the bran, bait being made up with each material as filler, but otherwise identical. A rather large swarm was selected for the work, one-half being treated with bran bait and the other with sawdust bait.

When the baits were applied, a few hoppers here and there were seen to nibble somewhat at the sawdust flakes. Unfortunately, heavy rain prevented observation the following day, and forty-eight hours elapsed before the plots could be examined. The sawdust bait gave results markedly inferior to those from the bran; there was a much lower kill as indicated by the dead on the ground, and there were sufficient survivors to allow a return to definite swarm formation, small bands of hoppers being scattered over the patch. The results did not warrant any further attempts to use sawdust in the bait mixture. In any case, it became obvious that any suitable materials used as a substitute for bran would need to be collected, packed, and transported to the infested districts at considerable expense.

Mass Bait Distribution.

On large holdings carrying extensive swarms, the ordinary method of distributing the bait—broadcast by hand—was rather slow. Mass baiting was successfully carried out in the following way:—The bait was mixed at a central spot and taken in a utility truck to part of the holding that meantime was being searched by one or two horsemen. The truck was then driven at moderate pace over the swarms that had been located, while two men in the back of the truck cast out the mixed bait. By using a tin plate as a scoop and making a vigorous cast, quite a large area could be effectively covered. This method needs careful supervision of the workmen, as patches of swarms here and there can easily be missed. Equally serious is the danger to stock where careless work is done, for the bait may sometimes fall in small heaps, which cattle or sheep are liable to consume.

Spraying Trials.

Coincident with the early baiting trials, some small experiments with spraying materials were carried out. The pump used was the ordinary knapsack spray pump of 4 gallons capacity. Two spray mixtures were tried, the first consisting of 4 oz. sodium arsenite in 4 gallons water, the second of 4 oz. arsenic pentoxide in 4 gallons water. Small swarms on short grass were chosen for these sprays, and an attempt was made to cover the swarms, regardless of the amounts of spray materials used. The sprays were applied at 3 p.m. on 20th September, 1934. At 8.30 a.m., 21st September, no living hoppers were found on either of the patches, the ground being thickly sprinkled with dead.

The hoppers not only ate the poisoned foliage, but also imbibed the fluid while droplets were still present on the grass a short time after spraying. It seems likely also that the soluble arsenicals would have a direct contact effect on the hoppers.

The amount of spray necessary for the work was then checked. Using a single nozzle on the spray pump, an area of approximately 8 yards by 6 yards was sprayed with 1 gallon, this being equivalent to a rate of about 100 gallons per acre. Using a double nozzle on thickly-infested headlands of a wheatfield, a strip 50 yards long by 2½ yards wide was sprayed with 4 gallons. This represented a rate of 160 gallons of spray per acre, but it must be pointed out that the area carried a fair growth of weeds and grass, and this was rather thoroughly drenched with the spray. Later, in a further measured trial, 4 gallons of fluid were spread over a circle a little over 18 yards in diameter, and a satisfactory kill of hoppers was obtained; this spraying represented a rate of approximately 75 gallons to the acre.

Modified Spraying Method.

An ingenious spraying equipment was tried in certain localities. It consisted of a small engine driving a pump, the whole outfit being mounted on the running-board of a car. The pump was linked by a hoseline to a spray tank also carried in the vehicle. A delivery hose then ran forward to a pipeline about 9 feet long clamped to the front bumper-bars of the vehicle, the pipeline being fitted with a series of nipples, each giving a flat spray directed forwards and downwards. With the pump working and the car moving, a strip about 12 feet wide was sprayed. The outfit was limited in its use to the country over which a car could travel, and it could not be directed to swarms among fallen timber or in rough country. The engine was small and low-powered, both for portability and on the score of costs, and it was found that the spray delivery did not allow of the vehicle moving more than about 4 or 5 miles per hour if a satisfactory spraying were to result.

Attempts to control swarms by merely spraying a ring of the arsenical mixture around the margin were unsuccessful. This ingenious spray arrangement in practice showed many limitations, in addition to those inherent in spraying methods generally.

Other Methods of Control.

During the grasshopper outbreak many alternative suggestions were put forward by the interested farmers and others for the control of the hoppers. These alternatives usually had little or merely temporary merit, but a brief discussion of some of them may not be out of place.

Burning.

One burning method gave surprisingly good results so long as suitable materials were available. An old hessian bag was tied with wire to the end of a short pole and partly dampened with kerosene. After lighting, the blazing bag was then waved close to the ground as the operator moved to and fro through the swarm. The kill was excellent, and the method would be valuable early in the control operations, pending the arrival of baiting materials. The most ardent advocates of this method had no hesitation in changing to the bait method when practicable, as the burning method was unquestionably hard and very

uncomfortable work. As supplies of old bags or hessian at a reasonable price are very limited, this method of control is suitable only for emergency purposes.

An alternative method—that of stringing several bags together—was tried. The string of burning bags was then dragged by two men, the bags between them, and a wide strip was thus treated at the one time. The results obtained by this modification of the burning method were very variable.

Where a hopper swarm invaded areas of dry herbage a grass fire could be very useful, but, unfortunately, the opportunities for adopting this practice were only too few.

It was not possible to test a flame-thrower at the time; so an opinion on this method of control used elsewhere cannot be given.

MILLING STOCK OVER SWARMS.

Some graziers claimed that by milling stock, particularly sheep, over a swarm of hoppers a good kill would be obtained. There is some reason to doubt the claim, as it cannot be reconciled with the following observation:—One of the egg-laying sites at Kooroongarra in May, 1934, had been located in a patch of heavy black soil near a gate used by dairy stock. When seen in September, it was hoof-pitted and obviously heavily trampled by stock. In spite of this, a hopper swarm of apparently normal dimensions emerged. Large numbers of eggs must have survived the heavy trampling of the beasts; the hoppers were, in turn, little affected.

PLOUGHING EGG-BEDS.

It has often been suggested that the emergence of hoppers can be prevented by ploughing the egg-beds. Cases were seen which gave the writer grave doubts as to the value of this method. Eggs were laid in an old cultivation paddock in May, 1934, and just before the September emergence the land was ploughed, cross-ploughed, and harrowed. Even following this treatment a hopper swarm emerged. In another area a single ploughing certainly had damaged large numbers of eggs, but sufficient survived to give rise to a dense swarm of hoppers. In any case, the ploughing of egg-beds is frequently impracticable, as they are often located in areas where implements cannot be used—for example, on land scattered with logs or stumps and on roads. A method of control involving considerable difficulties would be expected to yield better results than those in the examples cited.

Comparison in Control Methods.—Baiting v. Spraying.

At the outset there was some doubt as to the relative merits of baiting and spraying methods of control, but experience showed that the former was by far the most convenient and that there was a negligible amount of risk from the method.

The cost of the bran for large-scale baiting operations at inland centres is considerable, and the thorough mixing of the bait requires a fair amount of time. However, the preparation and application of the bait presented few difficulties. On a one-man farm the mixing could be done when temperatures were unsuitable for spreading the bait. On larger holdings where several men were employed in grasshopper destruction, some of the staff would mix and transport the bait to others who would be kept busy distributing it.

For a given area, the weight of bait required was much less than the weight of fluid needed for spraying. For example, sufficient bait for 1 acre would contain 36 lb. bran, $\frac{3}{4}$ lb. arsenic pentoxide, 6 lb. molasses, and $37\frac{1}{2}$ lb. water—a total of 80 lb. approximately, while the spray required for 1 acre would weigh 815 lb., made up of 5 lb. arsenic pentoxide, 10 lb. molasses, and 800 lb. water. Transportation difficulties in spraying are thus much greater than those involved in baiting. A power pump is indispensable for spraying large areas, and the method is only economically feasible in thoroughly cleared country. Hand-spraying by means of knapsack pumps was slow and arduous compared with baiting.

The relative danger to stock of spraying and baiting control measures is of some interest. Approximately $\frac{3}{4}$ lb. arsenic pentoxide would be incorporated into the average amount of bait used per acre; in the spray 5 lb. arsenic pentoxide would be used on the same area. Portion of the bait is eaten by the hoppers, and most of the remainder settles to ground-level, out of reach of grazing stock. In contrast, most of the spray lodges on the foliage and constitutes a distinct danger until leached away by the rain.

Practical Control Difficulties.

In central operations, locating the hopper swarms was a major difficulty. Even on the more closely settled areas hopper swarms could easily be missed, and this difficulty increased considerably in ring-barked country or open forest land. Hoppers are frequently concealed by surface litter and coarse, tufty grass. Further, if feed is scarce, they are more quickly dispersed over a wide area.

Interactions of Natural and Artificial Controls.

It has already been mentioned that Scelionid parasites were the most important agents of natural control during the outbreak. Fortunately, baiting methods of control of the hoppers could be applied anywhere at any time without affecting the Scelionid population; whereas a poison spray, burning, or comparable methods applied to young hopper swarms or over egg-beds would almost certainly kill numbers of Scelionid adults. The bait thus acted independently of the parasites, which would be quite undiminished by the artificial control and would be available for later parasitism.

Any method of hopper destruction must inevitably destroy internal Tachinid parasites. Nevertheless, while baits have no harmful effects on adult flies that may be working over the swarms, sprays or burning methods would actually destroy considerable numbers of the free-living insects.

The risk of killing insectivorous birds which might feed on poisoned hoppers was by no means ignored, but at no time during the campaign was there any observed mortality. Some domestic poultry died on one occasion when inadvertently allowed to feed over ground as it was being baited, but personal observation of the occurrence was not possible. It seems highly probable that in this instance a heavy application or an uneven scatter of the bait was made, this, indeed, being a characteristic of some of the earlier work.

The results of experiments published by F. E. Whitehead (Bulletin No. 218, Oklahoma Agricultural Experiment Station, June, 1934, "The Effect of Arsenic, as used in poisoning Grasshoppers, upon Birds") are reassuring. An abstract in the "Review of Applied Entomology," 22, pp. 687, 688, includes the following sentences: —

"In Oklahoma, domestic fowls and quail confined without food for twenty-four hours and then supplied with bran poisoned with 4 per cent. white arsenic (As_2O_3), which was scattered about the pens at the rate of 100 lb. per acre, showed no indications of poisoning after twenty-four hours. . . . . From a series of experiments in which 144 birds of various species were fed on grasshoppers, the following conclusions were drawn:—Fowls discriminate between poisoned and unpoisoned grasshoppers and eat less than half as many of the former; the amount of arsenic consumed by them in eating only poisoned grasshoppers averages less than half the toxic dose, and their weight and growth after sixty-six days is not materially affected; quails eating a normal number of grasshoppers would, if the latter were poisoned, receive only from 1 to 7 per cent. of a toxic dose of arsenic; there is practically no danger to adult wild birds from eating poisoned grasshoppers, though there might be slight danger to nestlings. Chemical analysis of the bodies of fowls that had eaten many poisoned grasshoppers showed that they could safely be used for human consumption."

The interactions between natural and artificial control measures appear to be very important, and the essential points seem worthy of emphasis:—

1. The poison bait method of control does not interfere with the operation of the egg parasites—the most valuable natural control agents.

2. Poison sprays (having contact properties), burning, and comparable methods used on young swarms inevitably kill scelionid adults.

3. To a lessened extent, this superiority of baiting over the other methods is maintained, even if other parasites are considered.

4. Insectivorous birds are not adversely affected by the correct use of the recommended control measures.

Organisation of Control Operations.

As the preliminary experimental work demonstrated that any one of the arsenicals would give satisfactory control, it was naturally decided to use the cheapest available. Arsenic pentoxide is sold to the farming community in Queensland for weed or pest destruction purposes by the Prickly-pear Land Commission at a specially reduced price of 5s. per 20-lb. tin, free on rail at the nearest railway station. Several farmers throughout the grasshopper-infested country were already in possession of some of this poison for weed destruction and tree-killing, and as further supplies could be easily obtained, arsenic pentoxide was generally recommended for baiting purposes.

During the spring generation of hoppers it was practicable for the landholders in the more affected localities to co-operate in control measures. Stocks of baiting materials were purchased by the several organisations, and these were subsidised by the Department of Agriculture and Stock by donations of equal quantities of materials. When, however, the adults from this generation developed and the local insects were supplemented by invaders from the South, it was realised that greater efforts were needed.

On 15th November, following a visit to the Goondiwindi area by the Secretary for Agriculture and Stock (Hon. F. W. Bulcock, M.L.A.), a special regulation under "*The Diseases in Plants Acts,* 1929 *to* 1930," containing the following main provisions was gazetted:—

1. The Shires of Waggamba, Inglewood, Pittsworth, and Millmerran were proclaimed quarantine areas on account of plague grasshoppers.

2. Every occupier or owner of land within the quarantine area was required to destroy larval plague grasshopper swarms by baiting or spraying in an approved manner.

3. All public bodies controlling roads, stock routes, reserves, or commons within the area were similarly required to apply control measures.

4. The ingredients used in the control measures were made available free to all interested parties. Applicants were required to declare that the materials were to be used solely for grasshopper destruction.

Central depots for the distribution of bran, molasses, and arsenic pentoxide were established in a number of centres scattered throughout and somewhat beyond the quarantine area. Public bodies assisted considerably by storing materials and issuing them to applicants. Employees were released from their normal duties to carry out baiting on lands under their jurisdiction.

Control work was taken up very enthusiastically in most localities, and numerous hopper swarms were wiped out, with a corresponding saving of much pasture. One of the motives behind the scheme of thus making bait materials available over a wide stretch of country was to provide a large scale demonstration of the value of the recommended control measures.

The official recommendations for the use of the bran bait were drafted following experience with the spring generation, but it was an allowable alternative to spray. Most of the landholders elected to bait, however, as this method of control is better suited to the varied requirements of the average holding.

The directions issued for mixing and applying both bait and spray were as follows:—

"DIRECTIONS FOR BAITING.

"BAIT FORMULA.

½ lb. Arsenic Pentoxide,
2½ gallons Water,
4 lb. Molasses,
24 lb. Bran.

"METHOD OF MIXING.

"Weigh the required quantity of poison and dissolve it in 1 pint of boiling water in one container. Mix the molasses with 1 pint of boiling water in another container. Stir each thoroughly. Divide the balance of the 2½ gallons of water—*i.e.*, 2¼ gallons—cold, between the two containers and stir. Add the molasses solution to the arsenical, and stir.

"Spread the required amount of bran on a mixing board or large sheet of iron or other impervious surface. Add the solution prepared as above and mix the whole to a moist, loose mash, making sure that no bran remains unmoistened.

"Keep the mixed bait in a loose state during transport to the field. Cover bulk supplies of bait to prevent loss of moisture.

"METHOD OF APPLYING.

"The limits of a swarm of hoppers, if not clearly defined, should be roughly determined. A strip 30 feet wide should be allowed in front of the swarm. The whole area occupied by the swarm and the strip in front should then be baited by broadcasting the poisoned bran in a finely divided state, as in the hand-sowing of grain. The bait should be thinly and uniformly applied. A quantity of bait representing 36 lb. of dry bran should be spread over 1 acre of baited ground.

"The application of the bait should be carried out in the warm part of the day, preferably between the hours of 9 a.m. and 3 p.m. A supply of bait sufficient for the day's requirements should be prepared in the early morning, so as to enable full use being made of the best hours for baiting.

"GENERAL COMMENTS.

"(1) The arsenic should not be touched, but should be manipulated with tin scoops, &c. Mixing should not be done by hand. Prior to applying the bait the hands should be coated with vaseline, petroleum jelly, or axle grease, particularly well around the nails. As soon as possible afterwards the hands should be thoroughly scrubbed.

"(2) Domestic animals, such as poultry, dogs, and so on, should not be allowed access to bulk supplies or mixing sites.

"(3) The bait should be applied fresh.

"(4) The effects of the baiting are evident after not less than twenty-four hours have elapsed.

"(5) The danger to stock roving over ground *properly baited* is negligible, owing to the small amount of poison involved and the thin distribution of the bait.

"(6) The baiting materials may be estimated sufficiently accurately as follows:—

2 2-lb. jam tins molasses = 4 lb.

2½ kerosene tins of loose dry bran = 24 lb.

"(7) It is essential that the grasshopper swarms be baited in the larval or 'hopper' stage, preferably during the first two or three weeks after emergence. Older hoppers will feed on and be killed by the bait, but, owing to the spread of the insects from the egg-beds, wider areas need to be baited. Grasshoppers in the flying stage cannot be controlled. Flying swarms should, however, be carefully watched so that egg-beds may be marked to enable the early baiting of the next generation of hoppers.

"DIRECTIONS FOR SPRAYING.

"SPRAY FORMULA.

1 lb. Arsenic Pentoxide,

2 lb. Molasses,

16 gallons Water.

"METHOD OF MIXING.

"Weigh the required quantity of poison and dissolve in 1 quart of boiling water in one container. Mix the molasses with 1 quart of boiling water in another container. Stir each thoroughly. Add these two solutions to the balance of the water required—*i.e.*, 15½ gallons water, cold, and stir.

"METHOD OF APPLYING.

"The spray should be applied by means of a spray pump with a fine nozzle. The infested area should be sprayed lightly with a fine mist so that approximately 80 gallons of spray solution are applied per acre infested with hoppers.

"GENERAL COMMENTS.

"As before, all precautions should be taken in handling and applying the poison.

"The spraying method is not officially recommended, but it is offered as an alternative to those who desire to use it. Any person using the spraying method does so at his own risk in respect to the possible danger of poisoning stock on the treated area."

As regards the best periods of the day for baiting, it was found that, for greater efficiency in the spring, baiting should not commence before about 9.0 a.m., and might continue until about 2.0 p.m. In the summer, however, it was found preferable to start earlier in the morning and to allow a break of about two hours at midday, continuing in the afternoon until about 3.0 or 4.0 p.m.

ACKNOWLEDGMENTS.

During the course of the grasshopper outbreak there were many who assisted in various aspects of the work, and thanks to all who collaborated are gratefully tendered. Particular reference may be made to Messrs. W. Dixon, Stock Inspector, Goondiwindi; W. Serisier, Shire Clerk, Goondiwindi; W. J. Tomkins, Whetstone; V. W. Gagen, Shire Clerk, Inglewood; G. Mabbet, Kooroongarra; H. McBean, Stock Inspector, Millmerran; F. C. Coleman, Stock Inspector, Pittsworth; to the members of the several local grasshopper committees at Rocky Creek, Kooroongarra, and Goondiwindi; to Mr. N. A. R. Pollock for a number of excellent photographs included amongst those illustrating this report; to Mr. I. W. Helmsing for the illustration of the life history of *C. terminifera*. Several reports by various officers of the staff have been freely used in compiling this report. Thanks are especially due to the Chief Entomologist (Mr. Robert Veitch) for his helpful interest in the work.

APPENDIX I.

A later outbreak of *Chortoicetes terminifera* was reported by Stock Inspector McBean in September, 1936. Adults first appeared as migrants in the Millmerran district about 1st September and commenced to lay immediately along the headlands of wheatfields and on roads. Mr. A. W. S. May, Assistant to Entomologist, visited the district and observed the conditions while oviposition was still in progress.

Hatching commenced on 6th October, thirty-five days after egg-laying was first observed, and hopper emergence continued for several weeks. Hopper emergence and egg-laying were both taking place on 6th October, but the insects now covered a wider area. The egg-beds were very extensive and were sufficient to initiate another large-scale outbreak. However, in common with the whole of South-eastern Queensland, the affected district was experiencing very dry weather when the hoppers emerged. In the absence of succulent herbage, the swarms of insects dispersed rapidly and most of them died within a few days.

It is interesting to note that, compared with the 1934 invasion, this outbreak showed what might be regarded as an inversion of generations. In 1934 the adults entered the district as migrants in March, oviposition occurred during April and May, and the nymphs emerged early in September. In 1936 the adults appeared in the district early in September, oviposition commenced immediately, and the nymphs emerged in October. Their behaviour on this occasion suggests that the grasshoppers had either over-wintered as adults or else climatic conditions had not been sufficiently severe to prevent development through the winter months.

APPENDIX II.

During the months of December, 1936, and January and February, 1937, the presence of *Chortoicetes terminifera* was reported from several localities, including Gatton, Toogoolawah, Thangool, near Callide, and Yarranlea.

A large swarm of hoppers was seen at Thangool, in Central Queensland, near Callide, during January. The pest had apparently

bred in the heavy dark brigalow soils, but it was impossible to find the egg-beds. The swarms showed a tendency to break up when they reached the adult stage. A few fields of maize were severly damaged, but the injury was not widespread. The insects showed no tendency to invade cotton, merely defoliating a few plants along the edges of fields. Couch and Rhodes grass were preferred.

The Yarranlea report evidently referred to progeny of the survivors of the spring generation discussed in Appendix I.

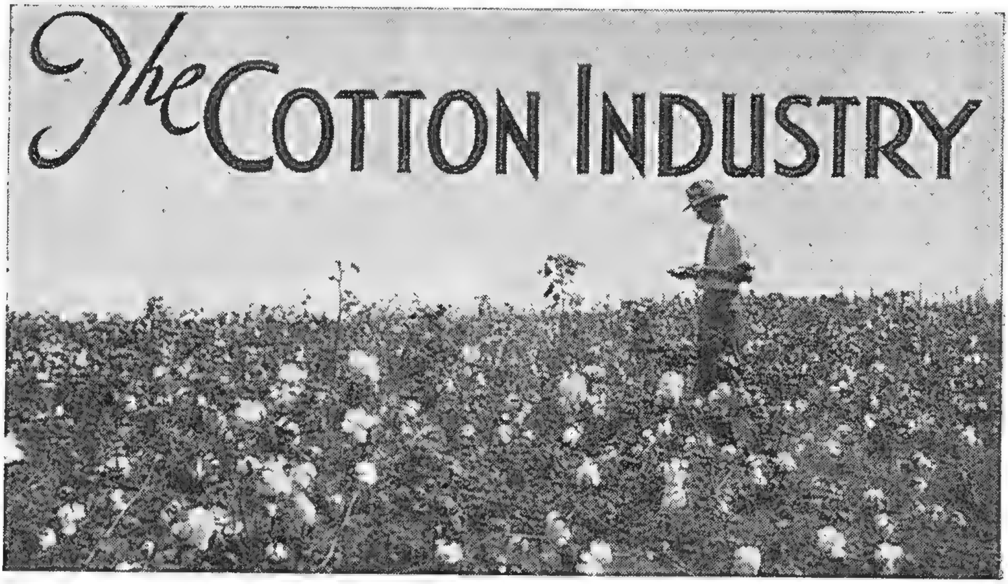
At Toogoolawah small egg-beds and hopper swarms were noticed towards the end of last year, but more recently dispersed swarms of adults have been flying in the district. Owing to the dry conditions that have prevailed in the locality for many months past, there was practically no herbage, but the adults defoliated what little there was, including small plants of the bullhead weed, *Tribulus terrestris* L., a species taken by stock in dry weather. The flying swarms fed on various crops, maize in particular, and also cotton, tomatoes, and pumpkin. The flag of the maize was stripped; quite frequently the midrib also was taken, while patches were seen in which plants up to 3 feet high were eaten down to stubble. The stalks of pumpkin vines were barked, causing in some instances the death of the younger foliage. The total loss due to grasshoppers in the district was not heavy.

Towards the end of April another generation had developed to the adult stage, and during a recent visit some rather extensive swarms of adults were seen. Small areas of certain crops such as oats, potatoes, and lucerne were damaged, but, as yet, the total losses in the Esk-Toogoolawah district were not heavy. Greater concern was felt with regard to the prospects in the spring as a number of moderately sized egg-beds were quite easily located. However, careful examination of these beds showed that they carried a large population of Scelionid egg parasites, and these parasites were found on egg-beds spread over a strip of country 20 miles long. The parasites were busily working on the surface of the ground locating egg-pods, and numbers of the latter showed signs of having been entered. The activity of these parasites suggests that they may destroy most of the eggs that have recently been laid and thus prevent a large scale emergence in the spring.

Parasites were collected and these have been kindly identified by Mr. A. P. Dodd. Of a large series of some hundred specimens collected in the Toogoolawah district, all except two specimens were *Scelio fulgidus* Crawf., the two others being *S. bipartitus* Kieff. A series collected in the Esk district was wholly *S. fulgidus.*

ERRATUM.

Since the publication of Section II. last month it has been found that the Scelionid material, referred to on p. 364, consisted of *Scelio fulgidus* Crawf., the record of *S. chortoicetes* Frogg. being introduced in error.



Harvesting Cotton.

R. W. PETERS, Cotton Experimentalist.

THE harvesting, or picking of cotton as it is commonly termed, is the most expensive single operation connected with the production of cotton. At present cotton is picked extensively by hand, which makes the harvesting a slow process.

The methods adopted in picking cotton have a decided effect on the quality of the resultant lint produced. Investigations in the United States of America have shown that the fewer cleanings cotton receives during the process of ginning the less damage will be done to the fibres. It has also been shown in England that the fewer cleaning operations the fibres are subjected to, the more suited they will be to the economical production of yarn of high quality. The harvesting of cotton, therefore, should be carefully carried out and every factor affecting the quality of the lint adversely should be guarded against.

Picking Cotton.

Picking should be commenced as soon as sufficient bolls are open to allow a moderate daily tally being obtained. An important point to observe is not to pick cotton when it is wet from either exposure or rain, or when it is green, a term used to describe fibres that have not dried out thoroughly following the opening of the boll. Not only is it difficult to clean leaf and trash from wet or damp cotton, but during ginning operations the saws cut the wet fibres very severely and tend to leave them in a twisted ropey state. Lint of this nature is easily detected and buyers penalize it heavily, for much waste is obtained from cotton during the spinning operations. In the wetter districts of the U.S.A. apparatus has been devised to dry the seed cotton before ginning, and the quality of the lint obtained from cotton treated

in such manner is raised at least a whole grade. In most seasons in Queensland no difficulty should be experienced with wet cotton, for the usual climatic conditions are suitable for the harvesting of dry cotton after the dew has dried up. Where picking is done while the dew is still present the wet cotton should be spread out in the sun during the forenoon, after which it can be baled with the rest of the picking of the day.

In the earlier years of the present phase of cotton growing in Queensland, the ginneries were equipped with cleaning apparatus which was not so efficient as that now installed, and it was necessary to pick the cotton rather cleanly in order to obtain high grade lint from it. As the premiums between grades were then rather high most growers endeavoured to send clean cotton, and this tended to slow up the rate of picking. With the present more efficient machinery it is not necessary to have the cotton as nearly "snow white" as many growers used to send it in order to obtain the best grades. This is particularly true where the farmer and his family pick the crop, and it is suggested in such cases that it would be better to pick the cotton slightly less cleanly, and thereby faster, for not only could greater tallies be obtained in the time available for harvesting the crop, but larger acreages could be grown and still be harvested without employing labour.

Plate 166.

COTTON CROP FULLY OPENED.—Cotton in this condition should not be left for any length of time, for exposure to the elements may result in serious damage and general deterioration of the crop.

In this respect, it is pointed out that in a normal season, in cotton picked prior to the occurrence of heavy frosts, the bracts and pieces of leaf are fairly tough and pliable and do not break up into small pieces as happens after they become brittle from the effects of frosts. Early picked cotton can thus contain a fair amount of big leaf and still yield lint of high grade, for the cleaning machinery removes the big leaf without breaking it to any extent. It is a mistake, therefore, either to pick so carefully as to have little leaf, or, worse still, to roll

the cotton between the hands to break up the large leaf. It is the small pieces of leaf which are difficult to remove from cotton, and seed cotton containing fine pieces of leaf or "pepper" leaf as it is termed have to be graded lower than cotton with big leaf. This is the reason the grades usually drop off after heavy frosts occur—the dead leaves and bracts are so brittle that they break into small pieces when picked with the cotton, and while the improved cleaning machinery eliminates much of this leaf, it is impossible to remove all; hence the necessity of grading the seed cotton lower than if the leaf was large and not brittle.

The most difficult matter to remove from the cotton lint is grass and weed seed, especially spear grass seed, and every effort should be made to clean the fields at the last cultivation so that no seed will be produced. On old cultivations even where good farming practices have been followed there is always danger of tall growing weeds setting seed late in the season, and it pays to chop out such weeds before the harvesting commences, especially if pickers are employed.

Plate 167.
RIPE FOR THE HARVEST.—A Field of Cotton, Mundubbera.

Another important point to guard against when harvesting cotton is not to leave the cotton exposed too long to the weather. Cotton, when bolls first open, has a nice richness of colour, or "bloom" as it is called, and it is necessary for a sample of cotton to have this "bloom" before it can be graded into the higher grades of the regular universal standards, although it may be free of trash. When cotton is left unpicked for several weeks the bloom is lost through the bleaching action brought about by the wetting of dews and the subsequent drying by the sun. This changes the colour to a chalky, dead white and also destroys the lustre of the fibres. The effect of storms on cotton is worse than the dews—the colour changes to a dull greyish tinge and even to a light bluish tinge when rains lasting several days are experienced. When rains do occur cotton should not be picked for several days, for the bleaching action of the dews and sun greatly improves the

colour, while the wind and heat of the sun fluffs out the fibres from the matted condition caused by the rain. The grower thus benefits in two ways by delaying picking after a storm until the cotton has improved in appearance—the cotton is of more value and no payment is made for picking moisture.

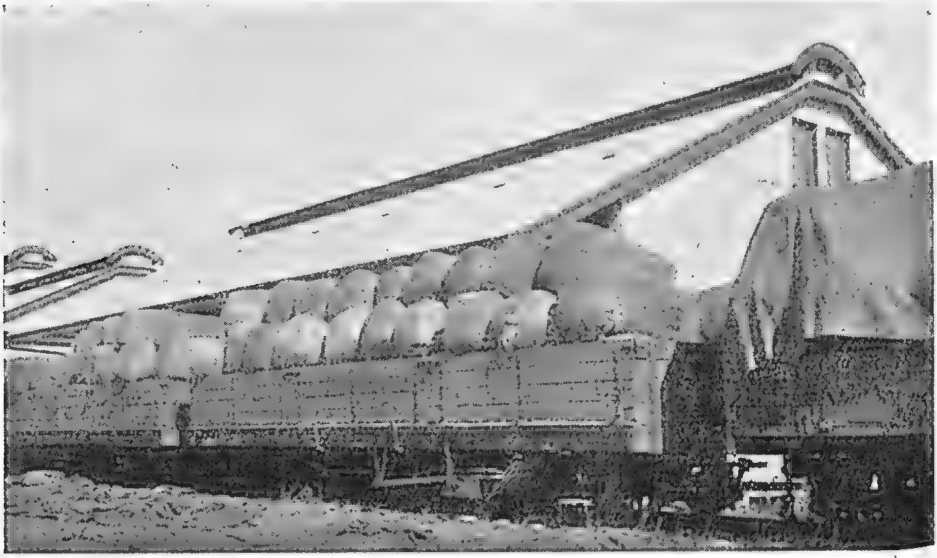


Plate 168.

QUEENSLAND COTTON ARRIVING AT THE GINNERY.—Second-hand wool packs are used for sending in the bulk of the crop. On an average 500 to 550 lb. of seed cotton is packed in each bale.

Another reason for not delaying the picking of cotton too long is the effect of winds on a well opened crop. With the continuous movement of the plants in windy weather the locks tend to hang out of the bolls in a long stringy condition. This not only allows the cotton to dry out excessively, thus losing weight and adversely affecting the character of the fibres, but also makes the cotton difficult to gin properly owing to a considerable proportion of the locks being in a twisted rope-like condition. Cotton left exposed to windy weather also usually gathers up bits of broken bracts and leaves, especially in frosted cotton. It is difficult to clean such trash in the ginneries, for the smaller pieces are generally twisted in amongst the fibres. In addition to these disadvantages much greater loss of cotton occurs during heavy storms by blowing cotton onto the ground. Where the harvesting is done by the grower and his family it will pay to make several pickings in a good crop, depending on the season. Where labour is employed to harvest the crop it has to be remembered that sufficient bolls have to be open to allow the picker to make a reasonable tally, otherwise the cost of picking will be high. Generally speaking it has been found satisfactory when employing labour to make one good picking and then a clean-up in fields of light to medium yield, and two pickings and a clean-up in good crops. The grower should be guided by the conditions as they exist. Sometimes it is better to allow a heavy picking to open and thus get it picked cheaper, than to seek a higher grade by an earlier, lighter picking.

Snapping.

Cleaning machinery is now installed at the ginneries for treating "snapped" cotton. "Snapped" cotton is obtained by snapping or jerking the whole burr and contents from the plant and should be practised only after heavy frosts have been experienced. The method originated in sections of the U.S.A. during a season of labour shortage, and the cheaper harvesting costs obtained quickly brought about the general use of the system, especially in places and seasons with high picking rates. Cleaning machinery was soon evolved to remove the burrs, extra leaf and parts of the plant gathered in the snapping operations. Undoubtedly the method is of decided value in many conditions, and especially so in Queensland in harvesting the top crop. It is pointed out, however, that "snapping" should not be substituted for picking cotton that has not been well frosted. Snapping unfrosted bolls tears the plant badly and the cotton when packed in containers for forwarding to the ginnery "sweats" so badly that it is difficult to clean and gin. In addition to this, freight is paid for green wet burrs, leaves and bits of the plant instead of light dead material. Snapping mature cotton undoubtedly lowers the grade to the point where the full value of the lint cannot be obtained. On the other hand, snapping the top crop of bolls which usually contains cotton of the lower grades not only does not lower the grades materially, but enables a considerable amount of cotton being harvested cheaply which would often not have been picked. Only bolls containing marketable cotton should be snapped, however. During the past season a considerable percentage of dry, hard diseased bolls or "hickory nuts," as they have been termed, were forwarded in the late snapped cotton. As these contain no cotton and are removed in the cleaning machinery before the seed cotton is weighed, the grower pays the pickers for nothing of value, and the Cotton Board pays freight on it as well, thereby reducing the amount of the later payments. Snapping is of value to Queensland cotton growers, but should be used properly.

Packing Cotton.

Owing to the distance of the cottonfields from the ginneries in Queensland the crop is forwarded by train either in bags or wool packs containing around 80 to 100lb. and 500lb. of seed cotton respectively. The growers of small acreages generally use second-hand corn bags, etc., while those with more than 5 or 6 acres usually purchase once used wool packs for their crop. It is cheaper to use the wool packs, for each grower's individual packs are returned for a small fee and may be used again. The fee is charged to cover the cost of sterilizing the packs and the cost of return to grower.

It is pointed out that before filling a container it should be cleaned carefully to remove everything that might affect the grade of the cotton; and wool packs which have had cotton in them should be especially cleaned in order to protect the purity of the seed. Growers should pay particular attention to this feature, for undoubtedly much contamination of pure seed varieties can be brought about by the admixture caused through bits of seed cotton sticking in the corners of bales and attached to strands of the sewings along the edges, etc.

When packing a container every care should be taken to have only the one grade and staple of cotton in it. A bale of lint is sold on the basis that it contains cotton of uniform grade and staple length. If

there is any variation of content encountered it is purchased on the basis of the lowest grade and the shortest staple contained. It is necessary, therefore, for the growers to assist in every way possible in obtaining uniformity of contents of the bale of lint. Very careful mixing has to be done of some wool packs received, owing to the layers of cotton of different grades pressed in them. Many large growers have the pickers empty their picking sacks directly into the wool packs, and where this is done layers of markedly different grade often result,

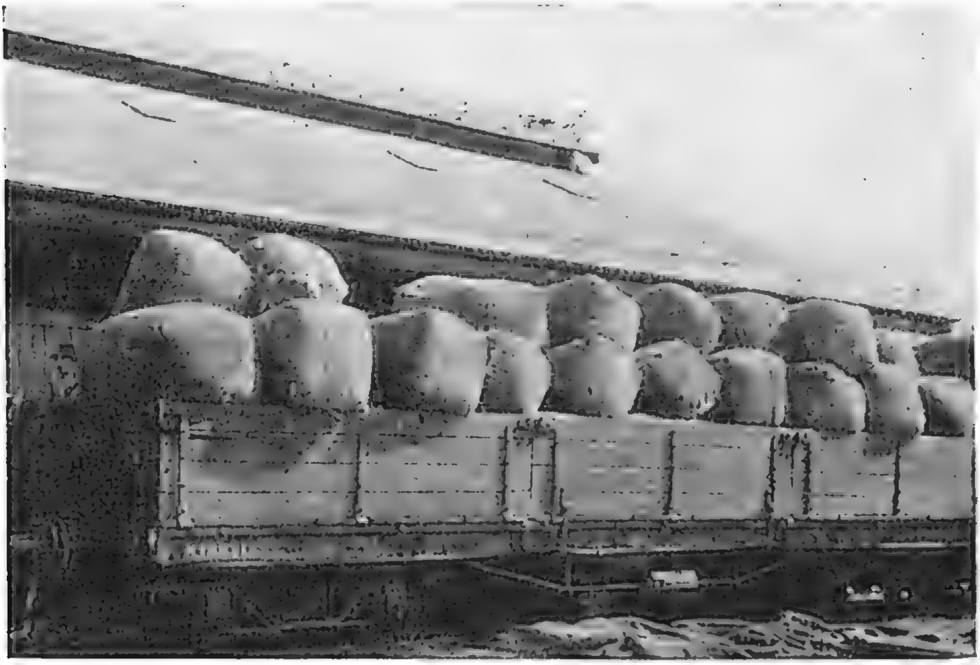


Plate 169.

UNLOADING WOOL PACKS OF SEED COTTON ON ARRIVAL AT THE GINNERY.—During the peak period of arrivals as much as 120,000 lb. of seed cotton is received in a day. Growers should therefore forward cotton in wool packs only in order to assist, as much as possible, the grading and receiving of the crop.

owing to some pickers picking more trashy cotton. It is recommended that the contents of each bag should be roughly graded by the grower and an endeavour made to segregate the different grades in his cotton into separate wool packs. The grading at the ginneries could then be done more quickly, in that it would not be necessary for the grader to stop and estimate the true value of a wool pack containing different grades of seed cotton, as is now frequently done, and in addition more uniform cotton would be fed to the gins, thus enabling the production of bales of lint containing only one grade in each. This matter is of the greatest importance, and it is again emphasised that more care must be exercised by growers in seeing that the contents of any one container are even in colour and quantity of trash.

Forwarding Cotton.

Every grower has a registered number and should include this with his initials and railway station in a brand for identifying each container he sends. The brand should be placed in a conspicuous place on the side of the container in black that will not rub or wash off.

Each season a number of wool packs are received at the ginnery which have no identification marks, or the brands are so indistinct that they are not legible, and it is only through checking up the advice notes which a grower despatches to the Cotton Board when forwarding his cotton that the ownership can be established. This slows up the work at the ginnery and should not occur, for it is a simple matter to brand the cotton carefully.

Labelling.

It is necessary to know the variety of seed cotton in each container that arrives at the ginnery in order to determine the estimated percentage of lint contained therein. The grower is paid on the basis of the amount of lint he forwards and the grade and staple thereof, and to arrive at the lint content it is necessary to know the variety grown. Where a grower has only one variety, no label is necessary as this fact is recorded at the ginnery, but in the case of more than one variety tags for each should be used. When more than one variety is grown on a farm, great care must be exercised to prevent mixture or loss of identity of the varieties and each container should be carefully labelled with the proper tag for the variety contained in it. The label should be sown on in the usual cross diamond method which protects it from being torn off.

Careful attention to the main factors discussed in this article should result in the farmer obtaining the maximum value for this crop, and the industry as a whole will benefit by marketing lint of a higher value which the spinners will purchase with full confidence.

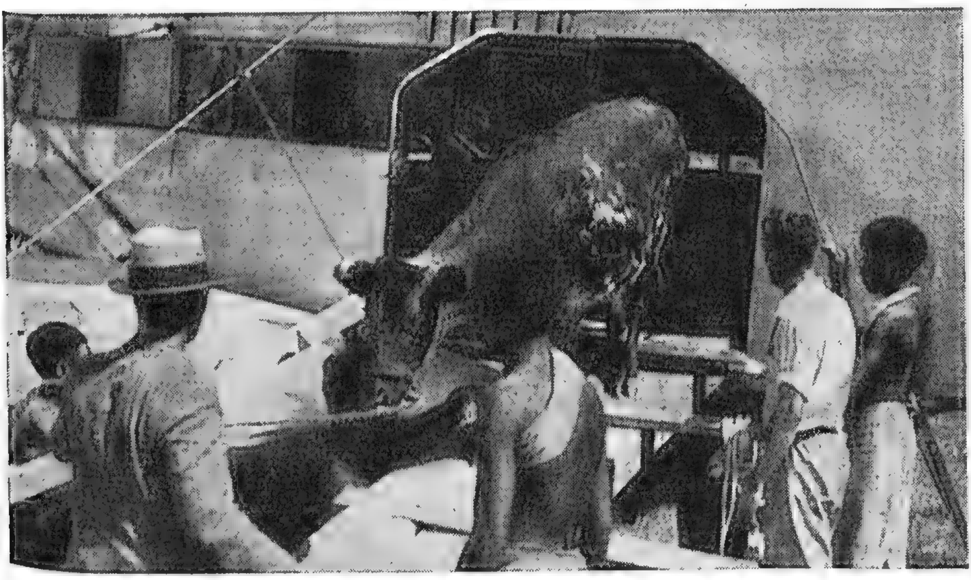


Plate 170.
Delivering Dairy Cattle by Aeroplane, New Guinea Goldfields.

COTTON.

Very favourable climatic conditions have mostly ruled throughout all districts during the past month, and good progress has been made in harvesting the earlier-sown crops. Receivals at the Glenmore Ginnery reached peak period volume at mid-month, but were of only moderate amount at Whinstanes. The general quality of the consignments to both ginneries is definitely of higher grade than usual for the first of the season. The total yield likely to be obtained is still problematical and depends on the nature of the rest of the season.

Following on the March rains, good progress is being made in the development of the top crops; also the December plantings are fruiting promisingly. Late frosts will be required, however, to ensure a good yield from the latter as a whole.

SUGAR.

Except for beneficial rains which were experienced in the far northern areas early in the month, April has been dry in all districts. Though the crop has not been severely checked as a consequence, absence of vigorous growth will be reflected in the final crop returns if these conditions persist.

At the present juncture a sugar crop of about 700,000 tons is forecast.

Preparation of Wheat Land.

Where the initial ploughing was effected shortly after harvest and sheep have access to the fallow, weeds will not be troublesome; but elsewhere every effort should be directed to the eradication of all weed growth, thereby conserving moisture for the succeeding crop. The method of working the land after the first ploughing will depend largely on the rainfall received, but it is generally accepted that rigid time cultivators will do the best work. Spring tooth cultivators and harrows are also useful in preventing the formation of a hard crust, so that all rains in excess of 30 points should be followed with a light harrowing or cultivating.

As a firm seed-bed is required it is important to progressively reduce the depth of working as seeding time approaches. Sheep are particularly valuable in consolidating the seed-bed, besides making good use of any available weed growth. Well prepared land should be ready for sowing at the correct time, according to the variety selected, as ample subsoil moisture will bring about a satisfactory germination. On the other hand hurriedly prepared land may have to wait for additional rain to effect germination, which is a great disadvantage, as early or seasonably sown crops invariably give the best average returns.

During the 1935-36 and 1936-37 wheat seasons average yields have been considerably reduced owing to the lack of adequate rains during the growing period of the crop, resulting in some instances in complete failure. However, in every instance where early ploughing was carried out, followed by the requisite workings after all substantial rains, profitable yields were secured.

In view of the example set by farmers who regularly practise the summer fallowing of their land, it is not surprising to note the gradual improvement in cultural methods now taking place. As the heaviest rains usually occur between harvest and sowing and only one third of the average annual rainfall is received during the growing period of the wheat crop, the necessity for fallowing is self evident.

Every year progressive wheat growers are proving the value of effective cultivation, although much remains to be done, particularly in the control of weed pests such as black oats.

Economies in seed, harvesting machinery, and wages can be obtained where a bigger return is produced from a smaller well prepared area of the farm.

H. W. BALL, Assistant Experimentalist.

Onion-growing.

Although the onion is not cultivated extensively in this State, many farmers in the Lockyer Valley regularly produce satisfactory crops of high-grade bulbs which meet with a ready sale in metropolitan and, occasionally, in the interstate markets. Onions are also being successfully grown in the Brisbane Valley, Kingaroy, and Darling Downs areas, while trial plots have indicated that good-quality marketable bulbs can also be grown in the Rockhampton and Mackay districts. However, the average aggregate area under crop throughout the State rarely exceeds 500 acres, the total production from which is insufficient to meet local requirements, necessitating the annual importation of heavy supplies from the Southern States.

As sowings are usually effected during April and May, the incidence of the rainfall received during the winter months is of the utmost importance, and, when deficient, has to be supplemented by irrigation. Owing to its deep-rooting habit, the onion can withstand limited dry spells, but the best results are obtained where the growing period is fairly moist, with drier conditions towards maturity and during harvest.

Rich, well-drained, sandy loams, friable and easy to work, have proved the most suitable, producing onions of good appearance and better keeping qualities than where grown on heavier soil types. Sandy soils tend to produce bulbs of good size but low keeping quality, while heavy soils will induce thickened or bull-necked plants.

The preparation of land intended for onion cultivation will now be nearing completion, and it must be remembered that deep cultivation should be avoided as the sowing period approaches.

The seed may be broadcast in seed-beds from which the plants are transplanted to their permanent positions in the field. Alternatively, the seed may be sown in the permanent drills. The latter method is usually adopted in Queensland, utilising the "Planet Junior" type of hand seeder, and placing the seed in drills 12 inches to 15 inches apart, which will be found to call for 2 to 3 lb. per acre. The seed should only be lightly covered with not more than ½ inch of soil, as deeper sowings germinate very poorly.

When the young plants are 4 inches to 5 inches high they are thinned out to a distance of 4 inches to 6 inches in between plants, a practice usually carried out with the aid of a 2-inch chipping hoe.

In the southern districts sowings may be commenced late in March, continuing until May, while in the central and northern districts the period can be extended to July. If sown too early losses may result from flowering, while if too late the bulbs may be small owing to insufficient time in which to mature before the hot weather causes scalding. Sow late-maturing varieties early and early-maturing varieties late. Only freshly grown, tested seed should be utilised, as onion seed deteriorates rapidly, and it is therefore preferable to buy seed from reliable sources.

The Brown Spanish type, including "Early Hunter River Brown Spanish," is the most popular, the onions being of good appearance and flavour and possessing good keeping qualities.

The hand cultivators of the "Planet Junior" type are useful for inter-row cultivation, as all weed growth must be kept in check. The soil should not be thrown up against the bulbs, the object being to draw the soil away rather than towards the plants, thus inducing the formation of bulbs. If the soil is not drawn away, bending over the tops with a twisting motion will assist in the formation of bulbs. When the seed-bed has been thoroughly prepared it will be found that very little hand weeding is necessary. Information on harvesting, &c., can be obtained on application to the Department of Agriculture and Stock, Brisbane.

H. W. BALL, Assistant Experimentalist.

Johnson Grass.

Johnson grass is gradually spreading in some of the agricultural areas in North Queensland, and farmers should become familiar with the plant, as it can be eradicated from small patches if dealt with efficiently. Once established over a large area no known method of eradication can be economically applied. The plant is very much like Sudan grass, and can be easily mistaken for it, but may be distinguished from this valuable fodder plant by its thick and spreading underground root stocks. Cattle have occasionally suffered from prussic acid poisoning when allowed to graze on the grass.

The roots of Johnson grass are carried from one part of the farm to another during agricultural operations and on the feet of animals. Being very thick and pithy, the rootlets may lie dormant in the soil for long periods in dry weather. When rain falls shoots are thrown out from the joints, and in a very short time a fresh area of the pest is well established.

When first noticed, every attempt should be made to prevent its spread. The infested area should not be cultivated and when possible it should be fenced off from the remainder of the paddock until the Johnson grass can conveniently be destroyed.

As pigs are fond of the thick succulent roots of Johnson grass, success has been achieved on many farms where the infested areas are small by securely fencing them off and turning pigs into the paddock. If the enclosure is handled in this way for a number of years, the pigs may destroy every vestige of the grass.

A quicker but probably a more expensive method of eradicating Johnson grass is by using a non-poisonous weedicide. Sodium chlorate may be applied, but commercial weedicides usually contain calcium chlorate as the killing agent. These substances are soluble in cold water, and are most economically applied as a light spray, for which the ordinary knapsack sprayer pump or some form of atomiser will be found suitable.

To get the best results Johnson grass should be sprayed when the plants are well out in flower. Further spraying may be necessary at a later date to kill out any regrowth.

Sodium chlorate is dissolved in water at the rate of 1 lb. per gallon. Commercial weedicides should be used according to the manufacturers' instructions.

O. L. HASSELL, Senior Instructor in Agriculture.

Sour Grass or Yellow Grass.

Within recent years the intrusion of sour grass into paspalum pastures in Queensland has been causing dairymen a good deal of concern. Sour grass is closely related to paspalum and is a native of tropical South America, now widely spread in moist tropical areas. It is a perennial grass, reaches a height of 1 to 2 feet, and spreads rapidly by means of creeping stems. Its foliage has a rather characteristic yellow tinge.

Sour grass is common on the Atherton Tableland and in wet coastal districts in North Queensland. Recently it has commenced to invade paspalum areas south of Gympie. As a fodder grass it is held in very low favour. Like the common mat or carpet grass, it has some value on poor soils, but when it invades paspalum pastures a decrease in the carrying capacity of the land is noticed.

Sour grass is similar in many respects to mat grass, and its control and eradication may in all probability be effected by the employment of measures which have proved efficacious in the handling of mat grass. The following recommendations are made:—

(1) Whenever small patches of the grass occur on a farm they should be dug out and the weed burnt.

(2) Where the invasion is too rapid to be stemmed by digging, a system of pasture management should be instituted which will allow the paspalum to grow sufficiently vigorously to keep the sour grass in check. This would involve subdivision of large paddocks, periodical renovation by the plough or pasture harrows, encouragement of clovers, and, possibly, topdressing.

(3) Cultivable pasture land invaded by sour grass could be ploughed and utilised for animal crops for two or three years prior to resowing with a pasture mixture.

(4) Smothering grasses, such as kikuyu and giant couch, may be grown in suitable areas with the object of keeping the sour grass in check.

(5) Where large patches of sour grass are involved the use of poison sprays would not be economical; small areas could no doubt be treated satisfactorily with sprays which are non-poisonous to stock (*e.g.*, chlorate sprays).

C. W. WINDERS, Assistant Agrostoligist.

SUPPLEMENTARY FEEDING OF STOCK.

Good foundations and framework are essential prerequisites to an elaborate building, and the same is true of a living organism. The skeleton or bony material must be well formed if it is to support the intricate mechanism of an active body. The skeleton is largely mineral matter, and of this material over 90 per cent. is composed of lime phosphate. During the intra-uterine period of its life and in the early sucking period, the young derives the whole of its mineral requirements from the mother. She in turn derives her supplies from the food she eats. When this is deficient in the required elements, nature enables her to draw upon her own reserves. Such is the overpowering force of maternity that a cow has been known to deplete her own body stores by 20 per cent. of their lime and phosphate content for the sake of the calf.

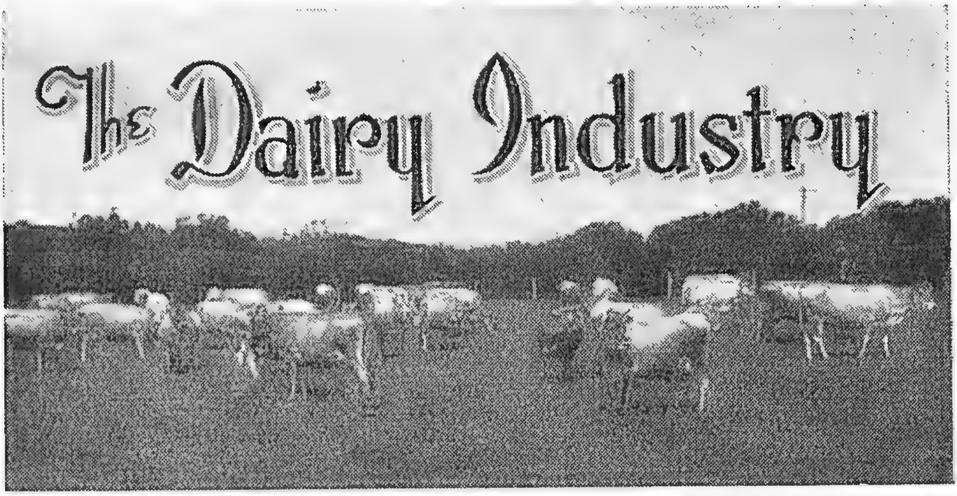
The growing animal and the producing mother require relatively large amounts of lime and phosphate to meet development on the one hand, and lactation or the needs of the unborn young on the other. The mature male or the unproductive female require much less.

As the mineral content of good pasture closely resembles that of animals themselves there is rarely any need to feed supplementary minerals when green grass is available. When the grass dies much of the inorganic (mineral) matter returns to the soil, and is unavailable to the animal. At this time the palatability of the grasses is affected, and stock are less inclined to eat all they require for maximum production. This reduced intake means a reduced mineral intake, and may lead to a temporary mineral deficiency. On certain types of country the soil, and consequently the vegetation it supports, is deficient in some minerals, and stock grazed thereon are in a constant state of malnutrition.

Under these conditions supplementary feeding becomes an economic necessity.

This has long been understood by the producer, but there has always existed some uncertainty as to the minerals required and the amount to be fed. On farm lands where the animals are under constant observation, and where the composition and palatability of the feed is known, the question presents little difficulty. On open grazing country complications arise. Apart from the requirements of the stock the difficulty of administration must be considered. The grazier cannot afford the individual attention to animals that farm stock get. He must aim at a mineral composition which corrects the deficiencies, and at the same time automatically limits the intake to the required amount. The problem is different for each locality, and results must largely depend upon the intelligent observation of the owner. In general, a mixture of well-graded steamed bone meal and coarse salt makes an efficient and palatable lick. The salt content should not exceed one-third of the composition, and where water analyses indicate it, the salt may even be excluded. A little appetiser must then be added to the bone meal. Price will govern which is to be used. The attraction which it holds for stock will determine the amount to be added. The quantity consumed will determine how often the material is exposed. When very fibrous food is being used it may become necessary to incorporate a purgative—5 per cent. sodium sulphate (Glaubers salt) is recommended.

Steamed bone meal should be fine, uniformly graded and of good analysis. The Department of Agriculture and Stock will report on samples submitted. Salt should be clean butcher's quality. On no account use second-hand material.—Dr. M. WHITE.



The Colour of Butter and Cheese.

O. ST. J. KENT, Research Laboratory, Dairy Branch.

IN controversies on butter quality, the subject of colour invariably arises, and much ado is made about the variation in appearance that sometimes occurs in butter from different districts or at different times of the year. The following notes are given in the hope that the colour of butter and cheese, and the factors influencing it, may be more fully understood.

A discussion on the colour of butter and cheese requires first of all a brief description of milk and its colour, since it is from this raw product that butter and cheese are made. Milk is composed of water and solids. In 100 lb. of milk there are 87 lb. of water and 13 lb. of solids. The solids are made up of fat 4 lb., milk sugar 5 lb., casein and albumin $3\frac{1}{4}$ lb., and minerals $\frac{3}{4}$ lb. Some of these solids are dissolved in the water in milk, whilst others are suspended in it just as clay is suspended in muddy water. All the milk sugar and albumin dissolve, whilst the fat, casein, and some of the minerals are suspended in the water portion of the milk. It is to the presence of these solids in suspension that milk owes its white or milky appearance, the milky appearance being caused by the scattering of reflected light by these suspended solids.

If different samples of milk are placed side by side and examined, it will be noticed that some are more tinged with yellow than others. This colour is due to the presence of a yellow colouring substance dissolved in the fat of milk. The yellow colour becomes more noticeable when the fat globules are concentrated in cream. It becomes still more apparent when the cream is churned into butter, and is most evident when one views the melted butterfat itself.

Skim milk also contains a yellowish colouring substance, which cannot be observed, however, until the milk is coagulated. When the curd separates from the whey, the colour of the whey is seen to be yellow with a distinct greenish tinge. This colour is caused by a colouring substance called lactochrome which dissolves in the watery portion of the milk.

Milk therefore is seen to contain two kinds of colouring substances—one which is soluble in fat and the other which is soluble in water. It is the colouring substance soluble in fat which is of interest to us, for it is this pigment which is present in butter and cheese. This yellow pigment found in butterfat is a very interesting and important substance. It is called carotin. It belongs to a group of colouring substances called carotinoids, which are very widely distributed in plants and are also found in many animals. Carotin, for example, is responsible for the yellowish colour of the fatty tissue and skin secretion of dairy cattle, especially Jerseys and Guernseys. Another carotinoid, which is very closely related to carotin and which is called lycopin, causes the red colour of tomatoes, watermelons, and other fruits, but has not been shown to occur in animals and certainly not in milk.

Carotin is found in all green plants, being manufactured by the plant itself, but it is not manufactured in the body of animals. The presence of carotin in milk fat is therefore due to a direct transfer of this colouring substance from the food eaten by the cow. This has been proved quite definitely by feeding experiments, which have shown that the amount of carotin in the fat increases or decreases, according to the amount of carotin present in the food. When cows are fed on such foods as cottonseed meal, timothy hay, white corn and yellow corn, the amount of carotin found in the milk fat is very low compared with that obtained from cows fed on green lucerne hay, green crops, fresh pasture grass, and similar foods.

Another interesting feature about this colour is that, of all mammals whose milk is commonly used for human food, cows alone give milk which has a pronounced yellow colouration of the fat. Milk fat from the goat, ewe, camel, and water buffalo is practically colourless, if not entirely devoid of colouring matter. The fat of human milk, however, is at times distinctly tinted by carotinoids. The reason why such differences occur is not known.

There is also a striking difference between the various breeds of dairy cattle with respect to the amount of this yellow colouring substance found in butterfat. Guernseys and Jerseys rank first in this respect, with Ayrshire, Shorthorn, and Friesians lower down on the scale.

In cow's milk the yellow colour will only be found provided that the food contains an abundance of carotin. This fact explains the seasonal variation in the natural colour of butter and also explains why butter from some districts is more yellow than butter from other districts. In those districts with a good annual rainfall, and consequently a plentiful supply of green pasture the colour of the butter is always brighter than that produced in the drier parts of the State. The colour of butter does not depend entirely on its carotin content, because there are many ways in which the colour may be altered. The pale creamy-coloured butter which is so well known in every household is the product of modern manufacturing methods. The butter-maker can control the colour within certain limits by altering his methods of manufacture. The temperature at which the cream is churned, the temperature of the water used for washing butter, the size of the butter grains, the length of time that the butter is worked, and the light of the factory, all have an influence on the appearance of the finished article. In some countries butter is artificially coloured, but in Queensland this practice is not carried out.

The consuming public have peculiar tastes for colours so far as dairy products are concerned. Queensland people at the present time demand very pale butter and look askance at any butter that has a bright yellow colour; yet on the other hand they seek highly coloured cheese, and look somewhat suspiciously at pale-coloured cheese. Generally speaking, there is nothing wrong with brightly coloured butter. In Queensland it usually signifies that the butter has been produced in a district where green pastures have been particularly abundant and is therefore a sign of goodness rather than a defect. In this respect the relationship between carotin and vitamins is of great interest. It has been shown recently that carotin can be transformed into vitamin A by the cow itself. The yellow colour of butter, such as is often seen in spring and summertime, is therefore suggestive of richness in vitamins, and the slogan ''There is Sunshine in Australian Butter'' is apt as well as attractive.

Occasionally butter develops quite abnormal hues. Green-tinted butter was reported a little while ago, and quite often butter with an extremely deep yellow colour is known to occur. These phenomenal butters can generally be traced to some unusual food consumed by the cows. It is well known that certain pumpkins will readily produce a deep rich yellow-coloured butter. Pale-coloured butter is also obtained from milk of cows approaching the end of their lactation period.

In the laboratory, colour of butter can be determined and colour values expressed in numbers. Furthermore, certain defects in butter are signalled by outstanding colour change. For example, a defect known as tallowiness is accompanied by a bleaching of the yellow colour of butter. Tallowiness is brought about by the oxidation of butterfat, and carotin on oxidation is known to lose its colour completely.

The colour of cheese is particularly interesting. Most cheese, unlike butter, is artificially coloured. The cheese manufacturers have to cater for the consuming public, and they colour their cheese accordingly. Cheese that is exported to England has to be either very highly coloured or not at all, and, in shipments overseas, the colour of cheese is either approaching brick-red or white. For the Queensland consumer a cheese of colour half-way between these extremes has to be manufactured. The so-called white cheese (actually a pale creamy colour) is naturally coloured cheese. Many consumers, in choosing a highly coloured cheese, doubtless believe they are securing a richer article than the white cheese, but such is not the case. The difference in colour in cheddar cheese, generally speaking, is due to the amount of harmless artificial colouring substance added to it.

The colouring substance used in cheese-making is called annatto. It is quite a harmless substance which is obtained from the seeds of the annatto plant, which is largely cultivated in India and America. The seeds when ripe are coated with a reddish powder, and it is this powder dissolved in suitable solvents that constitute the annatto solution used in cheese-making. It is very strong and only small quantities ranging from 1 to 4 oz. per 100 gallons of milk are necessary to colour the cheese.

In Queensland, cheddar cheese is our most common cheese, but there are hundreds of varieties of cheese manufactured in different parts of the world. Some of these have their distinctive colours—*e.g.*,

the Dutch cheese or Edam cheese is known by its pink or red external coat. Some fancy cheeses, such as Stilton and Gorgonzola, have blue-green streaks running through them, and others are manufactured with many distinctive colour peculiarities.

Cheese, like butter, may have its appearance altered by contamination with yeasts and mould growths. On the exterior of cheese a great variety of colours, due to mould growth, may sometimes be seen, particularly in moist hot weather, but little harm is done provided the rind of the cheese is intact. On the interior of cheese, bacterial defects may give rise to multi-coloured sections according to the type of contamination.

The colour of butter and cheese may not have such a strong commercial appeal as the flavour and aroma of these products, but it certainly plays its important part in the distribution of these valuable articles of diet.

In conclusion, it is hoped that in future Queenslanders will not treat a bright-coloured butter or a pale-coloured cheese with any undue suspicion. It may be stressed again that in this State no colouring substance whatever is added to Queensland butter.

Paspalum Ergot.

Paspalum is still the most popular summer-growing pasture grass in the coastal dairying districts. The widespread occurrence of ergot in this grass is therefore of considerable importance, since its presence may lead to sickness in stock.

The disease is first seen as a dark sticky exudate on the heads oozing from the developing seed. This exudate is due to the activity of a fungus parasite and contains countless spores or minute seed-like bodies by means of which the disease is spread from plant to plant by animals and insects.

Under suitable conditions, the stage described above is followed by the formation of resting bodies or sclerotia on the seed heads. The sclerotia are globular, about $\frac{1}{8}$-inch in diameter, and consist of compact fungus tissue. They are yellowish grey in colour and give the infected paspalum head an irregularly swollen appearance.

Paspalum ergot is closely related to ergot of rye, and, like it, is poisonous. The summer stage characterised by the sticky exudate contains little, if any, of the poisonous principle. The poison is produced in the sclerotia, and becomes concentrated as they get older. The symptoms produced in cattle resemble staggers. The poisoning does not usually result in the death of the stock, but losses may occur due to bogging of cattle in their weakened condition or to starvation if they are unable to rise.

The eradication of a disease of this nature from pastures is a very difficult problem. It can be kept in check, however, by the adoption of intensive rotational grazing, thereby largely preventing the formation of seed heads. Where a mower can be used this provides a supplementary means of getting rid of the seed heads before they form sclerotia. If, in addition to mowing, a quick fire can be got through the

cut grass the disease may be eradicated—at least temporarily. If badly diseased grass gets out of hand it should be burnt over at the first opportunity. Where difficulty is encountered in dealing with this disease serious consideration must be given to the replacement of paspalum with kikuyu or other suitable grass.

R. B. MORWOOD, Pathologist.

Flushing the Separator.

The test or percentage of fat required in cream should be not less than 38 per cent. during the hot summer months and not less than 34 per cent. during the cooler months of the year. Whatever make of separator is used, during the process of separating satisfactory results can only be obtained when the cream screw is adjusted so that the driven speed of the separator conforms with the corresponding number of revolutions per minute recommended by the maker of the machine.

At the completion of separating, flushing with cold or warm water so as to remove the last of the cream from the patties is an undesirable practice. If the cream bucket is not removed during the process, some of the impurities and slime adhering to the bowl may be removed and deposited in the cream. This applies particularly if warm water is used. When separated milk is used for flushing, excessive milk solids are introduced into the cream and these will act as a starter and affect the quality. Thus the proceeds of flushing should be fed to the pigs or calves on the farm. The maintenance of cream quality is too important to be impaired by laxity in this respect.

T. DOUGLAS, Inspector of Dairies.

Cleanliness in the Milking Shed.

Observations during milking operations on dairy farms in many cases reveal unclean habits, dangerous from a viewpoint of infection from germs and bacteria. Bacteria in milk and cream are well-known causes of low-grade, inferior products, and safeguards against their introduction into dairy produce are essential.

The milking bucket should on no account be used to wash the udder and teats of the cow or the milker's hands. The act of washing the udder transfers innumerable bacteria with the dirt and loose hair to the bucket, and a simple rinsing in cold water is not sufficient to remove them all. The need for separate milking buckets and washing buckets is therefore very obvious.

Receptacles with water for washing the cow's udders and also the milker's hands before milking each cow, and cloths for wiping them, are a necessary adjunct to cleanliness. The dairyman may well ask himself the question: "Would he take his meals with hands unwashed after completing milking operations?" The answer would be an emphatic "No!" Yet the cleanliness of his hands during milking is at least as important, for milk and cream are readily contaminated foods. Clean hands are just as essential during milking as at meals, and it is therefore curious that many people who are scrupulously clean in the home are lamentably careless in the cowyard and dairy.

Another very common practice is the wiping of soiled, milky hands on the clothing. These same clothes, if worn throughout the day, soon acquire a most objectionable smell and attract flies. Sugarbag aprons, which are easily made, inexpensive, and long-wearing, should be used by all milkers and frequently washed to obviate the unpleasant presence of stale milk on the clothing.

The protection of milk against flies is also a matter for consideration. Most dairymen have in use the large, flat milk vat, and this should be provided with a lid in which an opening has been left for the milk strainer, or, if milking machines are in use, for the releaser. This lid keeps out dust and vermin, and also assists in maintaining the temperature of the milk prior to separating.

Hand milkers frequently moisten the cows' teats during milking from the milk in the bucket. This practice cannot be too strongly condemned, as the hands are usually soiled, and bacteria from the udder of the cow are transferred to the bucket.

The following points are all practised by the most successful dairymen:—

Wash the udders in buckets used only for that purpose.

Wash the hands after milking each cow.

Wipe the hands on a clean cloth, not on the clothes, and wear either an apron or overalls.

Aprons and overalls are easily boiled, so keep them clean.

Don't use an uncovered vat. A cover is required by the Dairy Produce Acts.

E. C. DUNN, Inspector of Dairies.

Inferior Grade Cream.

One of the most common sources of the contamination of cream, and one that is often overlooked, is the badly washed cream can.

More cream is spoilt by being stored or carried in a badly washed can than by most other ways. This applies to cans in good order as well as those that are dented and rusty.

The reason is not far to seek. Hundreds of cans pass through the same rinsing water of the mechanical can-washer at the butter factory daily, and although a final steaming is carried out in the last stage of the washing process, it is not of sufficient duration (nor is it practicable) to thoroughly sterilise all of the cans thus treated.

Cans that have contained second-grade cream due to bacterial activity, such as cheesy and rancid flavoured cream, may continue to spoil future consignments unless attended to. Many cream cans carry a definite tallowy smell and the defect is sometimes traceable to this cause.

In order to safeguard the quality of cream it is advisable to rinse all cans on their return from the butter factory with boiling hot water to which a little washing soda has been added. The cans should then be rinsed with clean boiling water to remove all traces of the soda.

Thoroughly cool and aerate the cans in a clean atmosphere before using again. Do not rinse with cold water or wipe the insides of cans under any consideration.

C. L. MORAN, Instructor in Dairying.

Feeding of Calves.

About 87 per cent of cows' milk is water. Of the remainder, nearly one-third is fat, and a good separator, if properly operated, will remove about 95 per cent. of this fat. Very little protein is removed. It follows that if the separated milk is to be made equal in feeding value to the original milk, either the fat or its equivalent must be replaced. There is no need to replace protein, and for this reason it is not good practice to feed such protein-rich materials as linseed meal in conjunction with skim milk to very young calves.

Dripping obtained from a reputable meatworks, or cod liver oil. may be incorporated in the milk, but they are rather expensive and difficult to mix properly. A better system is to use finely ground maize. Maize meal from good-quality grain contains as much as 5 per cent. high-grade oil and 70 per cent. of easily digested carbohydrate which, to some extent, serves the same purpose as fat.

The new-born calf should get whole milk for a fortnight if it is to be given a good start in life. For the first few days it may be fed three times daily; after that, twice daily is enough. A safe level to feed is 1 gallon to each 100 lb. liveweight. At the end of the second week a little maize meal is stirred into the milk and the change to separated milk begun. By the end of the third week the maize meal may be built up to a handful, and the change to separated milk completed. By the end of a month the calf begins to nibble grass, and can consume about ½ lb. of meal.

From now on to the eighth week the milk can be replaced progressively by water and a meal mixture. By the eighth week the calf will be able to eat up to 2 lb. daily of a suitable meal mixture.

Such a mixture may contain 35 lb. of linseed meal and 65 lb. of a cereal meal. Pollard and bran should not constitute more than one-half of the cereal meal. The remainder may be crushed oats, barley, or maize. About ½ lb. of salt and 2 lb. of sterilised bone meal should be included in the mixture.

As the animals take more grass or hay, the supply of the meal mixture is restricted. At six months, unless an adverse period is encountered, the calf should be able to fend for itself.

DR. M. WHITE.

MILK AND CREAM TESTING EXAMINATION.

An examination will be held for certificates of proficiency in milk and cream testing and milk and cream grading on Saturday, 24th July, 1937; and in butter making and cheese making on Saturday, 31st July, 1937. The examination will be held in convenient centres. Candidates should notify the Under Secretary, Department of Agriculture and Stock, Brisbane, not later than the 5th July.

Entrance fee 5s. for each subject should accompany the notification, with an additional 10s. 6d. if a special country centre is desired as the place of examination.

Candidates must not be less than 18 years of age on the day of examination.

Does Manuring Pay?

H. W. KERR and G. BATES.*

SO many of our canegrowers have long known the absolute necessity for the use of fertilizers, if they are to maintain the productivity of their land, that the above question would to them appear superfluous. But there are a number of farmers who have still to learn the true value of these sources of plantfood, as an aid in reducing costs of production, and in restoring fertility to the land; and it is to those growers that we would present the striking results obtained from a fertility trial conducted on the farm of Messrs. S. J. Page and Son, of Edmonton, North Queensland.

This trial has now been continued for four years, and full yield data are available for the plant and three ratoon crops. The soil type is rather poorly-drained schist loam, which was producing inferior crops at the time the present owner entered into occupation. The use of the mole-drainer and tractor-grubber, combined with good husbandry, has so improved the general condition of the land, that it is able to maintain good cane tonnages, *provided it is supplied with the plant-foods which it so seriously lacked in its initial state.*

The land was considered as suitable only for the growth of Pompey, which variety was planted accordingly. The block had received a thorough preparation prior to planting. The trash from the old ratoons was ploughed under, and crushed limestone was broadcast at the rate of 2 tons per acre. A heavy crop of legumes was subsequently grown and turned into the land. Finally, the field was deeply grubbed just before the cane was planted.

The fertilizers applied on the experimental areas consisted of combinations, in pairs, of the following:—

N—420 lb. sulphate of ammonia per acre.

P—270 lb. superphosphate per acre.

K—150 lb. muriate of potash per acre.

One series of five plots received the full fertilizer application, amounting to 840 lb. of mixed fertilizer per acre, while a further set was given no manure of any kind throughout the experiment.

The crop yields for the four years were as follows:—

Crop Yields, 1933-1936.

Crop.	No Manure.	Sulphate of Ammonia + Superphosphate.	Sulphate of Ammonia + Muriate of Potash.	Superphosphate + Muriate of Potash.	"Complete" Fertilizer.
	Tons.	Tons.	Tons.	Tons.	Tons.
Plant cane	28·2	31·3	34·4	34·8	37·0
First ratoon	13·4	22·6	26·8	17·5	29·6
Second ratoon	11·9	21·6	22·9	13·4	25·5
Third ratoon	13·2	23·1	29·9	15·9	32·9
Total yield—4 crops ..	66·7	98·6	114·0	81·6	125·0
Average yield per crop ..	16·7	24·7	28·5	20·4	31·3

* In "The Cane Growers' Quarterly Bulletin" (Bureau of Sugar Experiment Stations).

Discussion of Results.

The above results present certain striking features. Following good preparatory treatment of the land—not overlooking, of course, the green manure crop—the unfertilized land yielded quite well, though the benefits from the manure on the fertilized plots were already evident. The value of the early treatment had, however, entirely disappeared before the growth of the first ratoon crop. The serious lack of available nitrogen, in this humus-deficient soil, was a very potent factor in rendering the unfertilized ratoon crops almost a complete failure, while superphosphate and potash also exerted their influence on the "complete" manure plots.

This low level of productivity on the unmanured area persisted throughout the trials, though the fertilized plot yields reflected the seasonal climatic conditions. The beneficial growing season just experienced resulted in a third ratoon yield of almost 33 tons per acre, where the land was suitably fertilized, while the unmanured crop was but 1½ tons in advance of the second ratoon yield of 1935. The trend of yields due to the several treatments is strikingly illustrated in the accompanying graph (Plate 171).

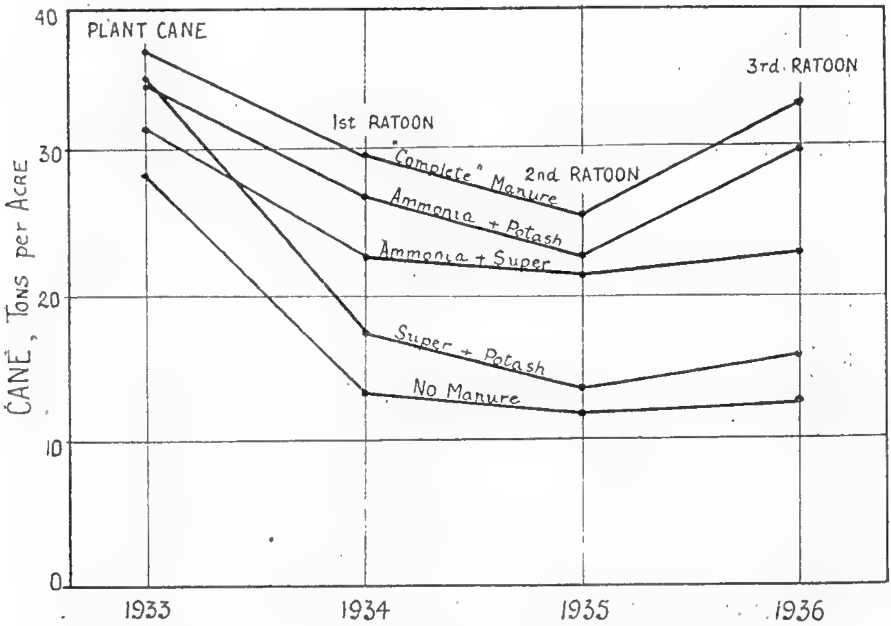


Plate 171.

A graphical presentation of the yield data for plant and ratoon crops.

Finally, a study of the average yields for the four crops show that the unmanured cane yielded 16·7 tons per acre, while the fully-fertilized crop gave an average of 31·3 tons per acre.

Recommendations.

The above returns indicate very clearly the natural deficiencies of the schist lands of North Queensland, where they constitute a major soil type. Profitable crop yields will be obtained only where due regard is paid to the plant-food applications given in the form of suitable artificial manures. An initial application of 4 cwt. per acre of Sugar Bureau

No. 2 or No. 3 Mixture provides the crop with an abundance of phosphate and potash, and subsequent top dressings of sulphate of ammonia (up to 4 cwt. per acre for ratoons), supply the necessary available nitrogen in which the land is so seriously lacking.

It should not be necessary to stress that on soils of this character, the benefits from green manuring during fallow are strikingly reflected in plant cane growth, and incidentally, eliminate the need for heavy manuring with sulphate of ammonia for that crop.

Plate 172.
Queen Mary Falls, near Killarney, South Queensland.

Does Cultivation Conserve Soil Moisture?

N. J. KING.*

THERE are four means by which moisture may be lost from the soil:—(1) drainage, (2) transpiration through the cane leaves, (3) transpiration through weeds and grasses, and (4) evaporation from the surface of the soil. The farmer has no control over the first two, and the third is attended to by cultivating and chipping until the cane is out of hand. It is the purpose of this article to discuss the fourth—evaporation losses. Farmers for generations have adopted the practice of preparing a surface mulch to prevent moisture losses, and a great many of our cultivation implements are designed to break up the first inch or two of soil and so produce the desired loose surface. This operation has a two-fold object—in destroying weeds and in creating the loose mulch with the idea of moisture conservation. But there are times of the year when weed control is not necessary, and yet after rain the grower scarifies the farm to mulch the surface and prevent undue evaporation of moisture.

The theory behind the practice is that moisture rises in the soil by capillarity and is evaporated by sun and wind on reaching the surface; the mulching, by destroying the capillary channels and forming a loose surface, thus prevents the moisture from arriving at the surface.

Some work carried out by the writer in 1933 had indicated that the upward movement of water by capillarity on the Woongarra soil was practically nil, and this observation prompted the investigation as to whether surface cultivation was of any value in preventing evaporation.

An experiment was initiated to obtain information on this point. Portion of a block under bare fallow was divided into four portions. Section (1) was hand hoed to a depth of two inches to maintain a surface mulch; section (2) was left bare—just as flattened down by the rains—but weeds were hand picked to maintain comparable conditions with (1); section (3) had a close cover of corn sacks in an attempt to prevent surface evaporation altogether; and section (4) had a cover of trash to measure its efficiency as a mulch as compared with the sack and soil mulches. Borings were carried out on these four sections every two or three days to a depth of four feet, and the moisture determined in 3-inch and 6-inch sections over the total depth. The experiment was started immediately after the April rains and continued until 2nd May, during which period no rain fell.

It is noticeable in examining the results (Plate 173) that the soil under the sack cover lost the least moisture by surface evaporation. The complete table of results obtained shows that very little difference exists between the bare surface plot and that which had a hoed surface. In fact the aggregate of all determinations proves that slightly less moisture was present in the hoed plot than in the other, due to the more rapid drying out of the surface two inches of mulch. The plot under the trash cover retained, on the whole, slightly more moisture in the surface two feet than that under corn sacks.

Two outstanding facts are discernible from this work. The first is that surface scarification as a means of conserving moisture is valueless on this soil type, and is uneconomical unless weeds are sufficiently

* In "The Cane Growers' Quarterly Bulletin" (Bureau of Sugar Experiment Stations).

bad to warrant removal. The second is the decided advantage of the trash mulch in moisture economy. It has been mentioned to the writer that after rain on this and other soils the sun tends to form a crust on the surface, and that scarification is necessary if only to break up this

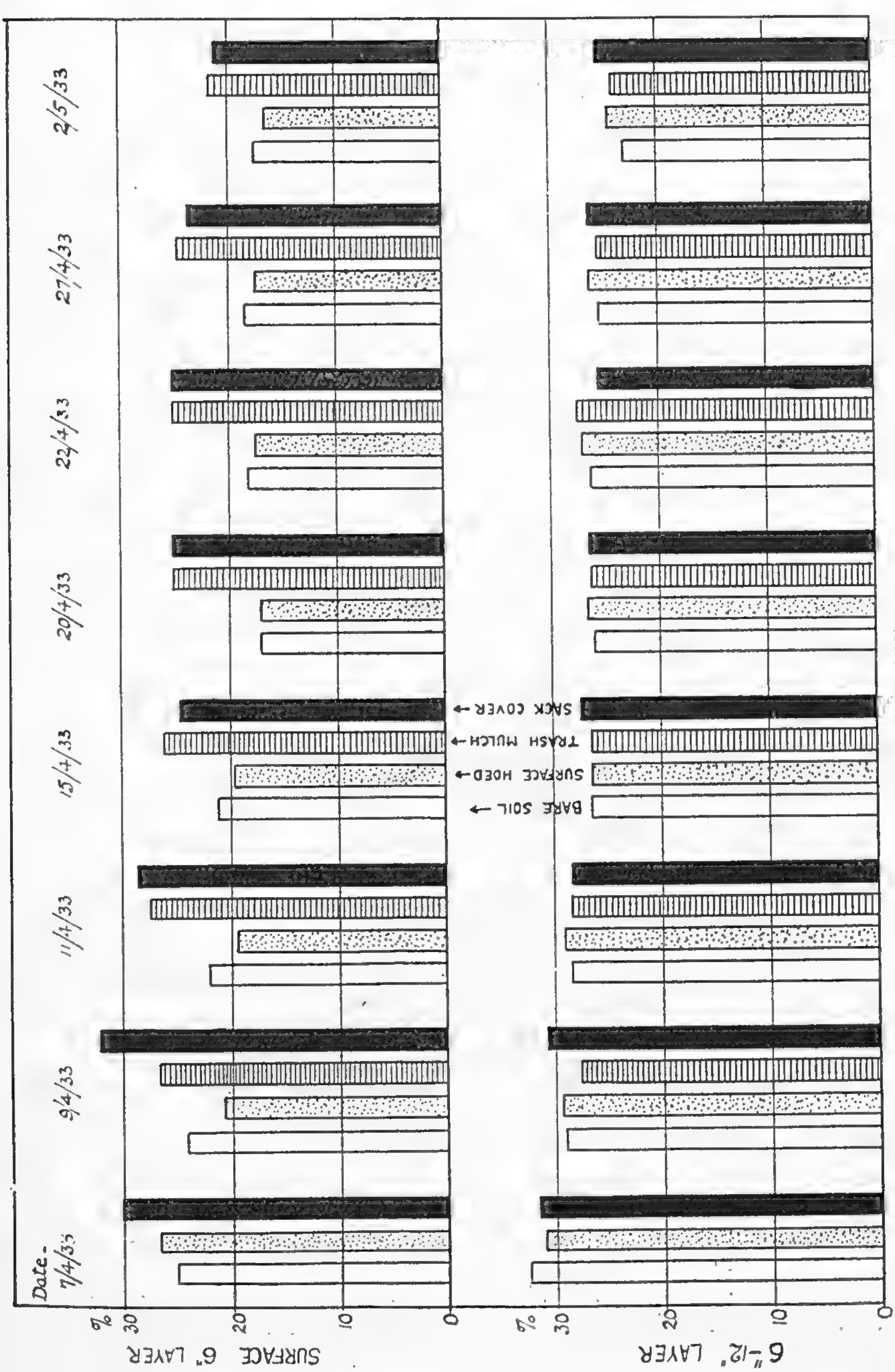


Plate 173.
A selection of the soil moisture data presented is graphical form. The influence of soil treatment is particularly noticeable in the suface 6" layer.

crust. In the writer's opinion the only harm this crust can do is to prevent or render difficult the coming through of young shoots after planting. It is certainly recommended that the crust be broken at this stage to allow young shoots through, but later on even the breaking of the crust would serve no useful purpose.

The results of this study were so directly opposed to popular belief that it was thought necessary to confirm them. Consequently the experiment was repeated in October, 1933, with exactly similar results. Since then publications from overseas have shown that identical conclusions have been reached in other parts of the world. The theory of mulching to prevent moisture losses by capillarity was supported strongly by F. H. King and E. W. Hilgard some 40 years ago. Since then Veihmeyer in California, Rohmstroff in Odessa, Call and Sewell in Kansas, and the Office of Dry Lands Agriculture in Washington have all found that the loss of moisture is practically the same from mulched as from unmulched surfaces; in some of the cases the mulched surfaces lost more moisture. The apparently contradictory results are explained as follows:—(1) It is found that where a water table exists within approximately six feet of the surface, capillarity effects, and consequently evaporation losses, are high. (2) Where the water table is below the six-feet level the effect of capillarity is not sufficient to cause large evaporation losses from the surface. In example (1) a surface mulch produced by cultivation implements would reduce the moisture loss, but in (2) the surface mulch would be useless.

Not many Queensland cane soils have a water table within the first six feet, so that scarification *for the sole purpose of conserving moisture* must be considered an uneconomical procedure.

QUEENSLAND SHOW DATES FOR 1937.

May.

Ipswich	11th to 14th
Roma	11th to 13th
Wowan—	
Show	11th and 12th
Rodeo	13th
Crow's Nest	Postponed to August
Gayndah	12th and 13th
Murgon	12th to 14th
Goomeri	18th and 19th
Mitchell	19th and 20th
Biggenden	20th and 21st
Gympie	20th to 22nd
Warrill View	22nd
Kilkivan	24th and 25th
Maryborough	25th to 27th
Charleville	25th to 27th
Gin Gin	28th and 29th
Toogoolawah	Postponed
Kalbar	29th
Childers	31st May and 1st June

June.

Bundaberg	3rd to 5th
Biloela	3rd to 5th
Lowood	4th and 5th
Boonah	9th and 10th
Gladstone Jubilee Show	10th and 11th
Marburg	18th and 19th
Rockhampton	22nd to 26th
Mackay	29th June to 1st July

July.

Kilcoy	1st and 2nd
Bowen	7th and 8th
Ayr	9th and 10th
Rosewood	9th and 10th

July—*continued.*

Pine Rivers	9th and 10th
Cleveland	9th and 10th
Townsville	13th to 15th
Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th to 22nd
Laidley	21st and 22nd
Maleny	22nd and 23rd
Cairns	27th to 29th
Gatton	28th and 29th
Emerald	28th and 29th
Caboolture	30th and 31st

August.

Crow's Nest	4th and 5th
Home Hill	6th and 7th
Royal National, Brisbane	16th to 21st

September.

Imbil	3rd and 4th
Ingham	3rd and 4th
Pomona	10th and 11th
Tully	10th and 11th
Rocklea	11th
Innisfail	17th and 18th
Malanda	22nd and 23rd

October.

Ravenshoe	8th and 9th
Millaa Millaa	1st and 2nd

November.

Murwillumbah	3rd and 4th

Charcoal for Pigs.

DIGESTIVE efficiency in farm animals depends largely on their capacity for grinding the food in small fragments. Thorough mastication is therefore linked with ease of digestion. Some animals may eat food rapidly without ill-effects. Thus the domestic fowl swallows quickly, but it has a remarkable mechanism in the gizzard for grinding the food to a fine state for subsequent digestion and absorption.

The pig is not so well equipped as the fowl to handle rapidly-eaten food, yet under most farm conditions fast eating is the rule. The pig can be helped to make better use of its foods in the following ways:—

(i.) By feeding easily digested material;

(ii.) By grinding the less digestible foods;

(iii.) By ensuring the animals sufficient feeding room;

(iv.) By arranging for some open grazing where the animals may eat at their leisure;

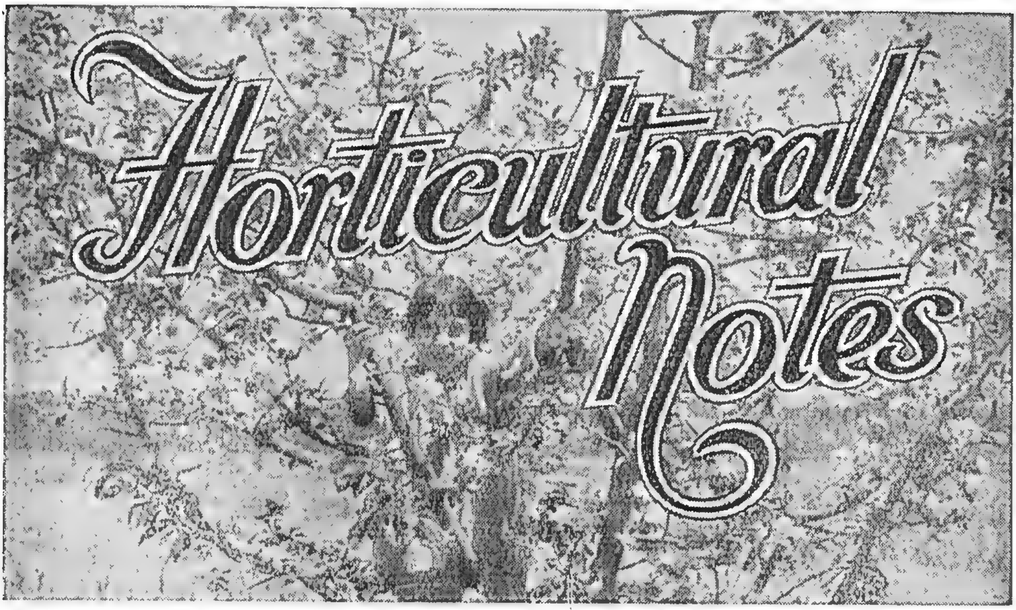
(v.) By feeding aids to digestion.

It is the last with which this article is concerned.

Charcoal and coke are extremely cellular materials and possess a great number of surfaces. At these surfaces rapid digestion of food can take place. By feeding either of them in powdered form, coarse lumps of food become coated with a film possessing an actively digesting surface.

An alternative and cheaper method is to throw coarse charcoal or coke into the pig sty and let the animals grind and eat as they feel inclined.

DR. M. WHITE.



Passion Fruit Growing on the South Coast.

J. McG. WILLS, Fruit Branch.

[*Continued from page 419, April, 1937.*]

WHATEVER method of cultivation is adopted, it is essential that the surface soil be broken up thoroughly at least once each year.

Where horse or tractor-drawn implements are used it is a simple matter to maintain a high standard of cultivation. On the steeper and rough locations, as well as on land which has not been stumped, cultivation, must, of course, be done by hand.

The soil should be well broken up to a depth of at least six inches, and this is best achieved by the use of mattocks or pronged forks. Light chipping with hoes will keep surface weed growth under control, but is of little assistance in maintaining the soil in a good state of tilth. This soil condition is essential for sucessful fruit production. By maintaining a good state of tilth moisture is conserved, the land is aerated, plant food is made more readily available, natural drainage increased, and control of pests and disease greatly assisted.

Vines must be kept growing and well cultivated from the start. They will then develop rapidly and come into bearing early. Vines insufficiently cared for when young become checked and subsequent development lacks vigour and does not produce the growth necessary to carry a profitable crop of fruit, while a greater amount of time must elapse before the vines commence to bear fruit. Older vines will also be retarded during hot dry spells and unfavourable seasonal conditions if cultivation is neglected. Under such conditions, weed growth becomes a serious competitor with the vines for the available soil moisture.

During the hot dry period of the year keep the soil well worked and weed growth in control. This will assist the vines materially to withstand the dry season, the whole supply of soil moisture will be available and should be ample to satisfy the plants' requirements.

On very stony ground cultivation will probably be confined to hand-pulling the weeds and chipping any clear spaces.

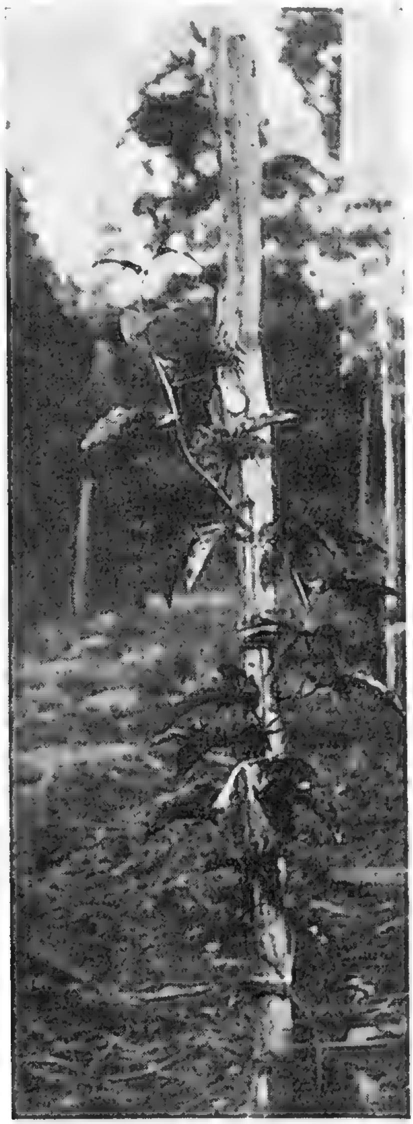


Plate 174.

A vigorous young vine two months after transplanting.

Cover crops, preferably legumes—such as cowpea, Poona pea, and vetches—should be planted between the rows in ample time to provide a good surface cover before the wet season sets in; or, if cover crops are not planted then, close-growing weeds should be permitted to remain until the heavy seasonal rains have passed. Such weed growth or cover crop will prevent the washing of surface soil, while if kept in check and not permitted to seed no harm to the vines will result, for at such a time there is ample moisture to support all the plant growth. After the wet season is over and the surface is dry enough to commence cultivation, all cover crop growth should be turned under, thus providing a valuable addition of humus and enriching the soil with valuable plant food.

FERTILIZING.

To be grown successfully, the passion vine, in common with most other vigorous growing plants, requires an abundance of readily available plant food.

If grown on good virgin scrub or forest land, ample plant food should be available for the first year or two.

On poorer soils and areas which have been under bananas for several seasons, a certain quantity of fertilizer will be required to provide plant food and maintain fertility.

Wherever farmyard manure is available, this should be collected for use in the vineyard, for even in small quantities it has a beneficial effect through the addition of humus and increase of the bacterial flora in the soil.

Use per acre in accordance with the quality of the soil a mixture of—

1 to 2 cwt. nitrate of soda;
4 to 8 cwt. blood and bone manure;
1 to 2 cwt. superphosphate; and
1 to 2 cwt. sulphate of potash.

With bearing vines, the manure should be broadcast and worked well into the soil. For younger vines, it should be applied close around the plant and well worked under.

Quick-acting nitrogenous fertilizer in the spring, or after pruning, will quicken new growth in the vine. Nitrate of lime or nitrate of soda applied at the rate of 1 cwt. per acre would be suitable for the purpose. The fertilizer is best applied in two dressings during the year—one, say, in July or August, and another in December or January.

PRUNING.

It cannot be guaranteed that pruning will increase the bearing capacity of the vine, but some control of growth must be practised if the vineyard is to thrive.

The principle reasons for pruning are:—

To keep the vine in good health.

To remove diseased, dead, and unprofitable growth.

To keep the growth in check on the wires in order to admit light and air and prevent congestion.

To induce the production of healthy, vigorous wood on which high-grade fruit is set.

To replace spent, bare leaders by the development of new ones.

To keep the lateral growth clear of the ground and properly spaced.

To regulate the time of bearing so that the highest market prices are obtained for the fruit.

To assist disease control and increase the life of the vine.

If left unpruned, vines soon become a tangled mass of wood and foliage in which fungus diseases may develop and rapidly shorten the life of the vine. It is essential, therefore, that an open habit of growth, admitting plenty of light and air, is maintained. All dead and diseased wood should be cut away and burnt so as to reduce risk of brown spot infection. Healthy, vigorous leaders and laterals produce the highest-grade fruit. The shortening back of lateral growth forces the vigour of the vine into the production of sub-laterals, thereby increasing the bearing surface and keeping the growth clear of the ground.

Plate 175.

A precocious young vines six months after transplanting. Note the fruits and twin stems.

Where laterals are permitted to trail over the ground the fruit may become scarred and otherwise blemished.

Pruning is a slow and tedious job, but if done well and carefully the grower will be repaid for time expended. Patience and intelligence are essential, for each vine may present a different problem to the pruner, and if the best results are to be obtained he will need to consider carefully its individual characteristics.

There is no hard and fast method of pruning for every grower's guidance. As a general recommendation, however, all dead, diseased, and weak wood, together with spindly, unthrifty, and non-bearing laterals, should be removed from the vine. Cut out all spent, long, bare leaders to induce the growth of healthy, vigorous ones in their place. Short, spindly laterals seldom bear fruit and only increase the density of foliage. Where laterals are shortened they should be cut back to a live, well-developed bud or shoot about 9 to 12 inches from the leader. Cutting back too severely is inadvisable, and may affect the new growth and bearing capacity of the vine. Where laterals are too numerous they should be thinned out to about 9 inches apart along the leaders.

All pruning tools should be sharp and in good condition and all cuts cleanly made.

Before attempting pruning or handling of the vines in any way precautions should be taken to prevent the spread of woodiness, in accordance with the recommendations of J. H. Simmonds, Senior Plant Pathologist, given in the pamphlet referred to at the end of these notes.

To enable the pruner to sterilize his hands and pruning tools readily and systematically, he should wear an apron with two pockets. In one pocket secateurs, knife, and other necessities can be carried, and in the other a piece of cloth soaked in 5 per cent. phenol or some equally effective sterilizing agent.

As soon as the operator has finished handling one vine and before commencing work on the next hands and pruning tools should be wiped thoroughly with the disinfectant. This action is soon performed almost subconsciously as a matter of course.

The passion vine should be pruned at least once each year, although two moderate prunings are preferable to one severe cutting. Some growers prefer to prune heavily during late winter and lightly after the main summer crop has been harvested, about February. Others prefer to reverse this procedure and prune lightly during the winter. Which method is adopted depends largely on local conditions, and is a matter for growers to experiment with. In any event it should be remembered that vines should never be pruned heavily during dry weather.

For the purpose of disease control, heavy winter pruning is preferable, as spraying is recommended by Simmonds during the summer months. It naturally follows that if the vines are well thinned out and cut back during the winter a better spray cover will be possible and the task made simpler and cheaper.

Light pruning at any time of the year will cause the vine to put forth new growth, and the development of this new growth regulates the production of fruit and its maturity according to the season in which it is performed.

When a summer crop is desired light pruning should be done during July and August, before the appearance of the spring growth. This

will cause the vine to burst forth into new growth on which the summer crop will set. Pruning done at this season means, however, the sacrifice of portion of the winter crop, for harvesting will not be completed and the fruit remaining when the laterals are cut back is lost.

Plate 176.

A six-year-old vine two months after pruning. Note the dense growth of new fruiting laterals.

The intermediate or autumn crop is produced by shortening back the flowering laterals between October and the end of November. This action means sacrificing the bulk of the summer fruit, and is only warranted if weather conditions are favourable for an intermediate crop. A late winter crop will be produced if the flowers for the autumn crop are pruned off during February.

In warm localities the vine puts on vigorous growth much earlier than in exposed and colder parts of the district. The grower is advised to note carefully his own local conditions, and prune to suit that particular situation, as growth varies considerably between vines planted on lowlands and those in upland vineyards. Sound judgment

is an essential factor in pruning. The grower can only acquire this through practical experience and a careful observation.

REPLANTING.

As the commercially useful life of a passion vine is generally about four years, if a grower wishes to continue some provision should be made for continuity of production. This may be done by rotation and by replanting.

Under normal vineyard conditions the heaviest crops will be produced when the vines are from two to two and a-half years old, after which they gradually decline in production and quality of the fruit. In order, therefore, to keep up a supply of good-quality fruit, new vines should be coming into bearing every two years.

Young seedlings may be planted midway between the older vines, and after the summer crop has been harvested every second vine may be cut out and the new vines trained on the trellis in the vacant space. As they come into bearing the remaining older vines should then be replaced, in turn, by fresh seedlings.

Although this method gives a replanting every two years, and a fairly high grade of fruit is produced, it has the disadvantage of necessitating an increased amount of pruning and spraying, as the young vines become infected with brown spot and woodiness to a much greater degree than if planted out in a fresh area.

By rotation areas can be kept isolated from each other either by distance or natural vegetation. Young seedlings planted out do much better under this system. They are not so much exposed to infection from diseased neighbouring plants, are more vigorous in growth, and produce earlier and heavier yields.

Under rotation extra trellises and more extensive cultivation are necessary. This additional expense is offset, however, by the advantages already mentioned. Under this system, too, the land can be periodically spelled from passion vine growing, and the trellises more easily repaired or replaced as required.

Whatever method is decided on, it must be borne in mind that to obtain the maximum profits from passion fruit growing provision must be made for the setting out of new vines at regular periods to replace the older ones as their production falls in quality and quantity. Experience suggests that a two-year system of replanting or rotation is the most satisfactory. This would necessitate the planting out of young vines during the spring of every second year.

A three-year rotation or replanting could be adopted, provided the vines remain healthy, vigorous, and productive. Practice has shown, however, that either rotation or replanting must be done at a shorter period than every four years if quality and quantity production of fruit is to be maintained.

HARVESTING AND PACKING.

Harvesting, packing, and marketing is quite as important as production, and every grower should aim at presenting to buyers well-matured, properly graded, attractively packed fruit. Enhanced prices

received for well got-up fruit will justify the time and labour expended on its preparation for market.

Fruit should be gathered daily, preferably in the early morning or late evening, when the fruit is cool and is then not so likely to arrive on the market in a wrinkled or shrivelled condition. All dropped fruit should be picked up first, as a couple of hours in the hot sun is sufficient to cause severe scalding and, possibly, render the fruit unsuitable for packing.

Plate 177.
Top and lower wire system adopted on Russell Island.

The degree of maturity at which the fruit is picked from the vine is of vital importance, and judgment is required in order to obtain the right colour without the fruit being so far forward that it is likely to wrinkle. Good colour is very desirable, and during the cooler weather the fruit should be picked when it has assumed a deep purple. However, during hot weather fruit should be gathered when just a light purple shade has extended over half to three-quarters of the surface of the fruit.

When harvesting during wet weather allow the fruit to dry off thoroughly before being packed. All fruit should be carefully picked to prevent the skin being damaged. This is best achieved by grasping the fruit in the hand with the thumb and forefinger on the fruit stalk, then with a forward pressure of the thumb and a backward pressure of the forefinger, the fruit will be easily detached at a point where the fruit stalk joins the tendril just above the dead flower.

The picked fruit should be placed—not dropped—into the picking boxes or tins, which should be placed on the ground or slung on the

body. These, when filled and until despatched, should be kept as cool as possible and sheltered from high winds.

Bordeaux spray can be removed by immersing the fruit in a weak solution of hydrochloric acid for one and a-half to two minutes, afterwards washing off with fresh water and being allowed to drain before packing.

Passion fruit forwarded to the fresh fruit market should be packed in half-bushel dump cases, and full instructions for packing the different grades are contained in an illustrated booklet which may be obtained on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Fruit intended for factory use need not be packed in cases, but may be forwarded to the canneries in sugar bags or similar containers.

DISEASES AND PESTS.

The passion vine does not usually suffer from any serious attack by insect pests. Spotting of the fruit results from the feeding activities of some minor sap-sucking insects, but little damage is done beyond a slight blemish of the outer skin. As the pulp is not affected the fruit is not harmed. Fruit flies have been known to attack the fruit in its green stage. The eggs, however, do not mature, but the skin surrounding the puncture becomes hard and detracts somewhat from the appearance of the matured fruit.

Fungus diseases such as brown spot and a virus disease known as woodiness or bullet, to which the passion vine is very susceptible, are the main causes for the premature failure in many vineyards. Powdery spot is a minor fungus disease which attacks the terminal growths and fruit during the cooler months of the year. Its attack is more serious on vines up to eighteen months old, since the proportion of the plant affected is then relatively greater.

Brown spot is the most troublesome disease affecting the vine. It attacks leaves, stem, runners, and fruit, causing considerable damage, and if neglected will result in the death of the vine within two years. Young vines are not so seriously attacked as older ones, as the more open growth admits light and air and permits most of the affected leaves to fall to the ground, carrying the fungal spores with them.

The recommended control for brown spot and powdery spot is to spray thoroughly with Bordeaux mixture of 4-4-40 strength. It must be remembered, however, that it is useless to spray a vine which has been allowed to become a tangled mass of runners and foliage. Correct pruning is a necessary practice in the control of these fungus diseases.

Woodiness is a serious virus disease, and growers are advised to exercise every care in an effort to prevent its spread. The following quotation from Simmonds summarises the precautions necessary for its control:—

> "Careful examinations of the plantation should be made towards the end of the winter, when woodiness will be showing up, and any plants exhibiting symptoms of this disease should be cut off at base so that the vine will have died and dried out before pruning time. Should a plant that has been missed be

met when pruning, the knife and hands, if used on a diseased vine should be washed well in methylated spirits or soapy water before passing on to a healthy plant."

J. H. Simmonds, M.Sc., Senior Plant Pathologist, has dealt with these diseases in a pamphlet, "Passion Vine Diseases," copies of which may be obtained on application to the Department of Agriculture and Stock, Brisbane.

[CONCLUDED.]

The Orphan Tree.

Many failures are noted where replacements are made in a bearing deciduous fruit orchard. Frequently, the young tree remains like an unwanted orphan and shows only stunted growth. If it is to catch up to the other trees and fill in an unsightly and unprofitable blank space in the orchard, careful attention must be given to all details in its management.

The main causes of failure are:—

1. The lack of natural plant food for the young tree.

2. If the old replaced tree died from the attacks of some particular diseases, the replant may be attacked in turn and suffer an initial setback.

3. Searching roots of adjacent trees may compete successfully with those of the young tree for the available plant food.

4. Lack of attention.

When digging out the unhealthy tree carefully remove and burn all the roots together with the tree. Leave the hole open and exposed throughout the winter, and just prior to planting in spring fill with a load of virgin soil to which may be added some well rotted animal manure. Virgin soil is obviously richer in plant nutriants than soil which has been cropped exhaustively for some considerable time.

The young tree is very often forgotten and does not get the necessary attention at the right time. Weed growth may tend to choke it, but this difficulty can be simply overcome by the use of an old fertilizer bag. The bag is opened out and, after making a cut in the middle, is slipped over the young tree. This makes an excellent mulch which keeps down weed growth in the vicinity of the tree and conserves the moisture so necessary for its progress.

A. M. RICHARDSON, Inspector, Diseases in Plants.

The Sugar Banana.

The sugar banana has been a profitable proposition for many years past on all the "bunch" trade markets in Queensland. Small, sweet and delicately flavoured, this fruit claims many staunch supporters.

For the production of this banana deep, warm alluvial flats, favoured with a generous rainfall or watered by irrigation, are most suitable. As with other varieties good drainage is essential. As the sugar banana possesses a slender stem, damage by wind must be guarded against, and where there is no permanent wind-break it is worth while establishing one at the time of planting. For this purpose double border rows of lady fingers or sugar banana plants may be planted 7 feet apart in the row and 7 feet between the rows. The spacings in the inner row should actually lie between the spacings in the outside row, i.e., planted according to septuple system. These two rows close quickly in towards each other and rapidly form an effective wind-break. Of course, the planting of a permanent wind-break of suitable trees would be far more valuable on account of their permanency, provided the cultivated area is reconditioned from time to time.

Prior to planting, the soil should be worked to a depth of at least 12 inches and reduced to as fine a tilth as possible. The holes for the young plants in the plantation area should be 14 feet apart, 15 inches deep, and 18 inches square. The rows should be lined out as straight as possible each way, thus allowing the greatest convenience in working horse-drawn cultivating implements.

Opinions differ somewhat in the matter of selection of planting material, but generally a vigorous young sucker about 4 feet high dug from a matured stool is most favoured. The top portion of the sucker should be removed, leaving a plant of 3 feet in height to place in the hole. The plant is placed in position within the hole and sufficient surface soil placed in around it to fill approximately two-thirds of the actual cavity. The rest of the cavity is filled in gradually, as the ground is culivated during the ensuing year. According to the quality of the soil one or two followers are allowed to come away, and, normally, the first bunches will be harvested seventeen or eighteen months after planting.

Farmyard manure applied judiciously to sugar banana plantations will repay the grower handsomely. Light horse-drawn implements are satisfactory for cultivating, and green crops, such as Poona and field peas, are excellent soil invigorators, provided they can be turned back into the soil at the correct time, i.e., when still very soft and succulent.

As the sugar banana is usually marketed in the bunch and the fruit possesses a thin, delicate skin special care in handling is necessary in order to obtain the best market returns.

E. P. WILLIAMS, Fruit Branch.

Water Blister in Pineapples.

Following on the recent rains numerous complaints have been made regarding the prevalence of water blister in pineapples arriving on the Southern markets.

Water blister infections occur only through freshly exposed tissue. Moreover, cuts, injuries, or skin cracks may become infected only so long as they remain moist. Consequently, water blister infections occur almost solely during picking and packing operations. In seasons of normal rainfall distribution infections take place chiefly through the cut or broken stem end, since—in fruit which has received careful

handling—exposed tissue is to be found only at this point. Such infections are classed as "stem end infections" in contrast to "side infections," which occur through breaks in the skin of the fruit caused by (*a*) careless handling or (*b*) climatic influences.

Stem end infections may be entirely prevented by strict adherence to the recommendations, which have been repeatedly given regarding plantation and packing-shed hygiene and the use of benzoic acid-kaolin powder. Growers are all doubtless familiar with these recommendations. However, side infections are more difficult to deal with. Apart from injuries resulting from careless handling, breaks in the skin of the fruit may occur in consequence of unfavourable climatic conditions during fruit development. A protracted period of dry weather while the fruit is developing results in it becoming "skin bound" as it approaches maturity. Should heavy rains occur at or about the time the fruit is ripening a rapid swelling of the tissues takes place, leading to the development of cracks and fissures in the tightly bound skin, particularly between the individual fruitlets or "eyes." Such growth cracks provide ideal points of entry for the water blister fungus, and side infections of this type have probably been chiefly responsible for the recent heavy losses on interstate consignments.

Obviously, side infections cannot be controlled by the benzoic acid-kaolin treatment recommended for the prevention of stem end infections, but losses from sided infections may be greatly minimised if not entirely avoided if the following additional precautions are closely observed at times when stem cracks are likely to occur:—

(1) When packing for distant markets discard all fruit showing abrasions or recent growth cracks, the presence of which is usually indicated by exuding juices. Ordinarily, such fruits are quite suitable for cannery purposes if processed without delay, or they may be disposed of through any local outlet which will permit them to pass into consumption quickly.

(2) Avoid packing fruit while still wet from rain or dew, and use only packing material which is thoroughly dry.

(3) Practise strict sanitation, both in the field and in the packing-shed. Tops and damaged or diseased fruit should not be left to decay in the plantation or thrown into a heap near the packing-shed, but should either be buried or removed to low-lying waste land where they are not likely to prove a source of infection.

(4) Spray the benches, walls, and floor of the packing shed with 5 per cent. formalin solution at weekly intervals throughout the summer crop.

H. K. LEWCOCK, Pineapple Research Officer.

Papaw Renovations and Planting.

The tops of many papaw trees, which suffered severely from the dry conditions prevailing during last year, died back and the plants are now making lateral regrowth from the stem. Properly handled, they may still be profitably worked for another year or two. A large number of side shoots will have developed from buds low down on the trees. Three or four of these should be selected and allowed to form a nicely balanced tree. The unwanted shoots should be cleanly cut off close to the trunk with a sharp knife.

The dry withered tops should be cut back to a solid partition or node, and covered with tins to prevent the entry of moisture into the hollow trunk. Otherwise, core rots may develop and ultimately extend right down to the base of the trees.

Where young papaws are to be planted, ample organic matter should first be worked into the soil. This is particularly necessary in forest soils, which may have been previously under papaws or other fruits for some years. Good dressings of fertilizer are also desirable, and the following mixture can be applied per acre:—1 cwt. nitrate of soda; 2 cwt. bone dust or Nauru phosphate; 1 cwt. superphosphate; 1 cwt. sulphate of potash; or 1 to 2 lb. per tree.

Where young seedlings are being planted it is advisable to place two or three plants in the one hole. Any male or unwanted tree which may grow can then be dug out after the plants flower, leaving only one female plant to each hole. A distance of 8 feet by 8 feet should be left between the plants so that there will be ample room for good development.

Only shallow working implements should be used amongst papaws to destroy weeds and grass growth. Deep working may injure the root system, which will retard the growth of the tree and affect the production of fruit.

E. F. DUFFY, Instructor in Fruit Culture.

Woodiness in Passion Vines.

The disease known to growers as woodiness or bullet is probably the most important trouble in passion vines. As it assumes greater proportions during the cooler months of the year, passion fruit growers are recommended to keep a strict lookout for symptoms of this disease if they wish to keep infection down to a minimum.

Woodiness is due to the action of an ultra-microscopic virus present in the sap of the diseased plants. It affects the terminal shoots, leaves, and fruit. Many growers have great difficulty in detecting diseased vines, as the foliage symptoms are rather obscure, and oftentimes recognition comes only with malformation of the fruit.

The younger leaves on diseased vines are usually crinkled and puckered in contrast to the smoothness of the leaves on healthy vines.

On leaves produced in winter the lobes may be drawn out into narrow, elongated, irregular shapes, and on close examination a faint light-green mottling may be seen. Badly diseased vines have a stunted and unthrifty appearance; the fruits are lumpy and misshapen, with thick hard rind, small fruit cavity, and very little pulp.

It is possible to spread this disease from infected vines to healthy ones during pruning, harvesting, &c., by transferring the sap from one plant to another on the hands or pruning tools, unless adequate preventive measures are adopted.

An inspection of the vineyard should be made at regular intervals, and about one week before pruning is commenced each vine should be carefully gone over, and any vine suspected of being diseased should be cut off at ground level, or pulled out of the ground, care being

taken not to disturb the aerial growth on the trellis. Then by the time pruning begins the diseased vines should be dry enough to remove without any risk of transferring the sap and so infecting neighbouring vines with which they may be entangled.

After handling a diseased vine and prior to commencing work on a healthy vine the hands, pruning tools, &c., should be freed from the virus by washing them in soapy water.

As an added precaution this act should be performed at all times when working among the vines, as soon as work on one vine has been finished and before proceeding to the next. This is advisable since, owing to the possibility of recent infection and the symptoms not being very pronounced, a diseased vine may escape the operator's notice.

The wild white passion flower is very subject to woodiness, and the symptoms are more easily recognised in this variety than in the purple passion fruit.

It has been noted that a large proportion of the wild plants are infected, thus forming a source from which the disease can spread to healthy vines in the vineyard probably per medium of the feeding activities of insects. Therefore the necessity for destroying all vines of this wild variety growing in the vicinity of the vineyard will be readily understood.

J. McG. WILLS, Fruit Branch.

IS BUTTON GRASS POISONOUS TO SHEEP?

Button grass is one of the best known and most widely spread grasses in Western Queensland. It comes away freely after the summer rains and soon dies off, but, like Flinders grass, is readily eaten by stock in the dried stage.

Recently this grass has come under suspicion as the cause of sheep-poisoning. The animals were yarded overnight preparatory to dagging. The sheep left untreated on the following day were then allowed the use of three small yards and a pocket with access to water. Early next day more than half were dead.

The stomach contents of two of the sheep were examined, and consisted almost entirely of leaves, stalks, and seed-heads of button grass. The sheep had fallen without any sign of struggle, most of them close to the water. The cause of death was uncertain, but it appeared that a large feed of fresh green button grass, plus a heavy drink of water, caused the sheep to bloat and die. They were, of course, quite empty when turned into the grazing yards.

A few years ago button grass was suspected of causing the loss of a number of rams untrucked after a train journey in the Richmond district. It has also been reported from Jundah that some sheep penned overnight in a yard that had not been used for many months, and in which there was a green and luxuriant growth of button grass, showed symptoms of poisoning next morning. Most of them recovered, but a few died.

Repeated tests of button grass for a prussic-acid-yielding glucoside have always given negative results, but in view of these records it would appear unwise to turn hungry sheep on to fresh button grass.

The symptoms do not, in all cases, point to bloat, and it must also be remembered that some grasses very closely allied to button grass are known definitely to be highly poisonous.

C. T. WHITE, Government Botanist.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

MARKET conditions during April were normal. Supplies of grapes and apples from Stanthorpe were considerably reduced. The quality of Granite Belt grapes this season has been excellent. Bananas have dropped off in quantity and quality, as a consequence of the dry weather during the period of development. At the present time consignments are not quite equal to demand so values should remain firm. Market prices for the month:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish—Sixes, 8s. 6d. to 13s.; sevens, 8s. 6d. to 15s. 3d.; eights and nines, 11s. to 15s. Lady Fingers, 3d. to 8½d. doz.; Sugars, 4d. to 7d.

Melbourne.—Sixes, 13s. to 14s.; sevens, 15s. to 16s.; eights and nines, 17s. to 18s.

The first consignments of fruit packed in bushel cases were sent to Melbourne on 30th April.

Sydney.—Cavendish—Sixes, 14s. to 17s.; sevens, 17s. to 19s.; eights and nines, 19s. to 21s.

For the present the cluster pack is not advised for use. Information is being given to Southern retailers with a view to its future adoption.

Pineapples.

Brisbane.—Smoothleaf, 4s. 6d. to 9s. per case, 1s. to 6s. per dozen loose; Ripleys, 7s. to 9s. per case, 4s. to 7s. per dozen loose.

Melbourne.—10s. to 15s. per case. Green fruit unsaleable.

Sydney.—8s. to 15s. per case.

With cooler weather the fruit should be permitted to advance to a riper stage than in summer.

Papaws.

Brisbane.—Yarwun, 8s. to 10s. a tropical case; local, 4s. to 6s. a bushel case; Gunalda, 6s. 6d. to 7s. 6d. a bushel case.

Melbourne.—12s. to 18s. a tropical case.

Sydney.—10s. to 15s. a tropical case.

Avocados.

Supplies of this fruit were received on the Brisbane market from the North. The quality was excellent, but an improvement could be made in the packing. Growers are advised not to send consignments to arrive on holiday week-ends, for to clear the fruit greatly reduced prices have to be taken.

Brisbane.—5s. to 9s. a half-bushel case.

Sydney.—12s. to 14s. a half-bushel case.

Melbourne.—12s. to 15s. a half-bushel case.

Granadillas.

Some good quality fruit from Magnetic Island was inspected. This fruit was harvested slightly too soon. The best indication of maturity is when the flower end of the fruit changes slightly in colour. There is a good demand for good quality granadillas, prices up to 10s. per case for best quality fruit being realised.

Custard Apples.

Heavier supplies are now coming on the market, with a consequent easing of prices.

Brisbane.—2s. 6d. to 3s. 6d. a half-bushel case.

Sydney.—4s. 6d. to 5s. 6d. a half-bushel case.

Melbourne.—3s. to 5s. a half-bushel case.

Immature fruit is unsaleable on the Southern markets, as it turns black and hard in appearance.

CITRUS FRUITS.

The supply of oranges has been irregular, with prices unsteady. The poor primary crops, due to the drought, have no doubt been the cause of the irregularity.

Brisbane.—Commons—Gayndah, 11s. to 13s.; Howard, 8s. to 11s.; locals, 8s. to 10s. Navels—Gayndah, 11s. to 14s.; locals, 10s. to 12s.

Melbourne.—Queensland Navels, 10s. to 18s.

Sydney.—Local Valencias, 5s. to 10s. Mandarins.—*Brisbane.*—Glens—Gayndah, 15s. to 17s.; locals, 9s. to 11s. Fewtrells, 8s. to 9s.; Emperors, 8s. to 11s.; Scarlets, 9s. to 10s.

Melbourne.—12s. to 16s.

Sydney.—10s. to 12s.

Lemons.—Gayndah Specials, 13s. to 16s.; standards, 12s. to 13s.; locals, 8s. to 11s.

Sydney.—Lemons, 14s. to 16s.

Grape Fruit.

Brisbane.—7s. to 9s.

Sydney.—6s. to 10s.; cured to 15s.

Melbourne.—10s. to 14s.; a few specials higher.

Passion Fruit.

Brisbane.—First grade, 9s. to 10s., Specials to 10s. 6d.; second grade, 5s. to 7s.

Some nicely packed lines of this fruit are now on the market, and, as the prices show, are definitely reaping the benefit of the care taken.

DECIDUOUS FRUITS.

The grape season is now practically closed in so far as Stanthorpe is concerned. Experiments in obtaining a suitable packing filler for cold storing grapes have been successful. A sawdust has now been obtained which, after processing, is free from dust and taint and comparing favourably with cork.

Prices.—Waltham Cross, 6s. to 8s. per half-bushel case; Purple Cornichon, 7s. to 9s.; Muscatels, 3s. to 5s.; Ohanez, 5s. to 6s.

Apples.

Some excellent Granny Smiths and Jonathans have been seen on the market.

Prices.—Granny Smith, 7s. to 9s.; Jonathan, 6s. to 7s.; King David, 5s. to 7s.

Pears.

Excellent quality Winter Coles have been obtainable, ripening perfectly; other varieties show better quality than usual.

Prices.—Parkham's Triumph, 6s. to 8s.; Winter Nelis, 7s. to 8s.; Winter Cole, 7s. to 10s.

Persimmons.

Good quality fruit is saleable; small undersigned fruit is not wanted.

Prices.—5s. 6d. to 6s.

Tomatoes.

Good packing is still a great factor in effecting sales.

Prices.—Ripe, 3s. to 6s.; local green, 3s. to 6s. Stanthorpe and New South Wales, 7s. to 8s.; Specials higher.

Vegetables.

Beans, 5s. to 7s. a sugar bag; peas, 6s. to 9s. a sugar bag; lettuce, 6d. to 1s. a dozen. Greatly improved packing methods have added to the quality of lettuce now obtainable. A leaflet showing how the packing is done is obtainable, on request, from the Under Secretary, Department of Agriculture and Stock, Brisbane.

LEAF SCALD OF PINEAPPLES.

During the autumn, young pineapple plants frequently suffer considerable disfigurement from a conspicuous disease known as leaf scald. The disease derives its name from the fact that on drying out, affected tissues commonly take on a bleached or scalded appearance to produce large elongated whitish or straw-coloured spots which sometimes extend right across the leaves. The spots may be found in almost any pineapple field during the autumn months, and at times they become exceedingly numerous. They are usually most prevalent on vigorous young plants which have made rapid growth since planting. The disease is rarely found on hard-leaved stunted plants.

The spots vary considerably as regards size, shape, and colour. Many are large and white, and are noticeable from a long distance, while others may be small and inconspicuous. Typically the spots are characterised by an elongated straw-coloured central area surrounded by a dark margin. The typical light colour of the spots makes its appearance only on leaves that are exposed to sunlight. Spots developing in the shade are usually blotched or streaked with brown.

The parasitic agent responsible for leaf scald is probably the same fungus which causes soft rot (water blister) of pineapple fruits and base rot of newly-planted suckers or slips. It attacks the leaf-tissues through abrasions made by the sharp edges and serrated tips of neighbouring leaves. The extent to which the leaf tissues may be attacked and, consequently, the size of the spots which subsequently develop, is determined largely by weather conditions. Muggy, showery, or cloudy weather favours the development of the disease, while dry sunny conditions have the opposite effect. When plants are well shaded, whole leaves may sometimes be destroyed. The disease is purely a seasonal one, and rarely occurs after the middle of May.

Owing to the rapidity with which the spots may develop under favourable conditions, growers not infrequently become greatly alarmed by the occurrence of this disease in their young plantations. However, it should be remembered that the injury to any individual plant is comparatively slight, and does not warrant special measures for its prevention.

Except in the case of an exceptionally severe attack of leaf scald, it is unlikely that the vitality of affected plants will be appreciably impaired.

Some Fodders, Pasture and other Plants Reputedly Poisonous to Stock—Symptoms and Suggested Treatment.

CONSIDERABLE correspondence has in the past been handled by the Department of Agriculture and Stock relative to livestock poisoning due in many instances to the consumption of certain fodder plants and grasses which, whilst valuable as fodder, are, under certain conditions, apt to cause digestive and other troubles.

The droughty conditions which obtained during the 1936-37 period were responsible for increased attention to this subject, and numerous enquiries were made in connection therewith, whilst a request was received from a certain farmers' organisation that a publication be prepared for the use of farmers and stockowners in which a list of fodders and pasture plants known to possess certain deleterious characteristics, together with the antidotes and treatment suggested for such, be given. In this connection the combined services of the Veterinary, Chemical, Stock Foods, Botanical, and Agricultural Branches were enlisted, and the following information compiled for the benefit of all stockowners.

PLANTS CAUSING PRUSSIC ACID POISONING.

Perhaps the most important of the fodders likely to cause trouble to stock are those belonging to the sorghum family, which includes—

- Sudan grass
- Johnson grass
- Wild sorghum (*Sorghum verticilliflorum*)
- Saccharine sorghums—
    - Imphee or Planters' Friend
    - Saccaline
    - Orange cane
    - Amber cane
    - Early orange
    - Black sorghum
    - Honey sorgho
- Grain sorghums—
    - Kaffir corn (red and white)
    - Feterita
    - Milo
- Broom corn (broom millet)

and any other sorghum, all of which, irrespective of name, contain prussic-acid-yielding glucosides in their young stages. However, the amount diminishes with the degree of maturity of the plant. Whilst under normal climatic conditions a certain tolerance is enjoyed by stock, dry periods are frequently responsible for attention being drawn to the risks incurred by injudicious grazing management.

Although not now extensively grown, the old variety of sorghum known as Black Sorghum (*Sorghum nigrum*) was responsible for considerable trouble, but the risk of poisoning has been greatly reduced by the introduction of varieties such as Imphee or Planters' Friend, Amber Cane, Early Orange, and Saccaline.

The popularity that has been attained by Sudan grass is no doubt due to its many good qualities, including its suitability under normal conditions to grazing without any extensive troubles arising from the practice.

Under droughty conditions the performance of sorghums and Sudan grass is apt to become uncertain, and in cases where cattle have been grazing for a long period without ill-effects fatalities have occurred and have invariably been associated with plant immaturity and the presence of hydrocyanic acid (prussic acid) yielding glucosides.

The similarity of Sudan grass to Johnson grass is, in many instances, responsible for the inclusion of the latter in a crop of the former, resulting in more or less hybridisation and subsequent danger to stock if seed from such should be permitted to germinate and a crop therefrom subsequently eventuate. Johnson grass yields prussic acid to a much greater extent than Sudan grass and therefore is so much more dangerous. Due to the ease with which members of the sorghum family hybridise or cross-fertilise, the greatest of care should be exercised in the selection of seed, taking into consideration the possibility of such hybridisation.

Generally speaking, it is safe to say that members of the usually accepted fodder sorghums are quite suitable to feed once the plant has reached the flowering stage, but even under these conditions cattle should not be given access to a growing crop if in a starved or empty condition. Allowing the plants to wilt after cutting renders them safer to feed, and, further, prevents animals that are ravenous from eating too fast and too much—a frequent cause of trouble.

Broom Millet, also a member of the sorghum family, although not generally classed as a fodder, is sometimes utilised for grazing and is possessed of the same disabilities as other sorghums in regard to the danger of its indiscriminate use as fodder.

Johnson grass (*Sorghum halepense*) is a robust perennial grass three to five feet high, its chief characteristic being the possession of numerous well-developed white underground stems or runners. Pieces of these runners are capable of developing into fresh plants. The spikelets or seeds are barely a quarter of an inch long and are densely covered with silky hairs. The commercial seed, however, owing to the threshing process, does not carry these characteristics.

Wild Sorghum (*Sorghum verticilliflorum*) is common in Queensland and is probably more abundant than Johnson grass, with which it is often confused. It is a taller, more robust grass than Johnson grass, growing 6 to 8 feet high. The leaves and stems are often stained a purplish red. It does not produce runners as does Johnson grass. The spikelets or seeds are a quarter of an inch long and covered with silky hairs.

Several other common plants may be responsible for prussic acid poisoning of stock. The plants referred to are as follows:—

Frost-resistant Rhodes grass, winter-growing Rhodes grass, or evergreen Rhodes grass (*Chloris distichophylla*).—This grass, which is a

native of South America, has been of recent years sold as a fodder grass. It is characterised by its heavy broad leaves and a large number of spikes in the seedhead. These latter number from forty to fifty, and the brown spikelets or seeds are covered with fine silky hairs.

Guinea grass (*Panicum maximum*).—Guinea grass, which is a native of tropical Africa, is now widely spread over eastern Queensland, and contains prussic-acid-yielding glucosides in small quantities, though no definite case of poisoning has been noted. It is a robust, tall grass with rather broad leaves and showy, wide-spreading seedheads. It is not cultivated to a great extent in Queensland, but is nevertheless fairly common.

Birdsfoot Trefoil (*Lotus corniculatus*).—This is a rather small legume with yellow flowers. It is characterised by having, in addition to the three leaflets of the ordinary clover, two extra leaflets at the base of the leaf stalk. The flowers, which resemble miniature pea flowers, are born in small heads at the end of a slender flower stalk. The flowers are followed by round pods an inch or so in length. This legume is occasionally sown in Queensland for grazing purposes.

SYMPTOMS AND TREATMENT.

The poisonous principle derived from the above mentioned plants is hydrocyanic acid (prussic acid). The symptoms and treatment of prussic acid poisoning are as follows:—

Acute Cases.

Prussic acid being such a rapidly fatal poison if taken in sufficiently large quantity, there are few or no visible symptoms to describe, but where sudden deaths occur for no apparent reason among healthy animals, prussic acid poisoning should be suspected. The post mortem examination of an animal immediately after death has occurred shows congestion of the lungs, fluid, black, and oily blood, the cavities of the heart contain bubbles of gas, and all parts of the corpse have a faint smell of bitter almonds. There may also be varying degrees of inflammation of the stomach and intestines.

Subacute Cases.

These cases occur when the animals concerned have not taken sufficient quantity of the plant to cause instant death. There is usually a period of excitement with great salivation, quick pulse and breathing, then the abdomen becomes enlarged due to the formation of gas in the paunch (in cattle) followed by diarrhoea. Later, convulsive spasms occur with dizziness and staggering and gradually paralysis, leading to loss of consciousness and death.

Treatment.

Keep the animal as quiet and warm as possible by covering with rugs in a dry stall, and, if possible, remove the poison from the stomach by passing the stomach tube. The best treatment, and for which the drugs should always be kept on hand, is the administration of a drench of ferrous hydrate which must be freshly made by mixing carbonate of soda (washing soda) and sulphate of iron. The mixture is made by dissolving one ounce of washing soda in one pint of water, dissolving half-an-ounce of sulphate of iron in a separate pint of water, and then

mixing the two together. This quantity should be sufficient for a cow, and about half a pint for a sheep. If drenching cannot be done it is advisable to pour the mixture into the paunch of the cow through a canula, inserted as for bloat, a hand's breadth forward of the hip bone behind the last rib on the near side.

Sulphate of iron may be bought for about 3d. per lb., and washing soda for slightly less. A few pounds of each kept on hand for emergencies might obviate a serious loss.

Molasses, diluted sufficiently for drenching, has also been recommended by various people, a quart being considered sufficient for a cow.

PASPALUM ERGOT POISONING.

Following widespread outbreaks of ergot disease in the common paspalum grass in the 1935-36 and 1936-37 growing seasons, numerous cases of stock poisoning as a result of infected seedheads being eaten were experienced. The trouble is likely to recur in paspalum-growing districts in seasons favourable to the development of the fungus causing the disease in the seedheads. Paspalum is a densely tufted grass with broad green leaves and two to seven spikes of seed at the top of each seed stalk. The poisonous substance is present in the fungus on the seedheads.

Symptoms.

It will be noticed in dairy cows that milk production suddenly drops, and the affected animal loses condition rapidly, and though it will move about and graze to a certain extent, its movements are those of a sick beast reluctant to move. Some disturbance of the digestive system is present, usually impaction, but scouring may be seen. No marked fever with increase of temperature, pulse, and respiration is manifested.

Typical lesions are noticed on the muzzle and teats, which become red and sensitive, and gradually the skin of these parts becomes cracked and peels off, leaving a raw exposed surface. A discharge from the eyes and nose is usually present, and the animal may show varying degrees of lameness, from slight stiffness to staggering of hind limbs, with sometimes muscular twitchings and shivering.

Contrary to popular belief, abortion in cattle is uncommon in the disease as manifested in Queensland.

Treatment.

This must be applied in the early stage if loss of milk production is to be avoided. Drench at once with any purgative in order to get rid of the offending matter. A mixture which has been found useful is 1 lb. of Epsom salts and 1½ oz. of ginger dissolved in a quart of warm water. If recovery is slow a tonic should be given as:—

Ferri. Sulph. Exsic.	2 drachms.
Pulv. Nux. Vom.	1 drachm.
Mag. Sulph.	2 ounces.
Pulv. Gentian	2 drachms.

Give one powder night and morning in treacle for three days.

Vaseline or any soothing ointment should be applied to the sore teats.

To prevent the trouble, the affected grass should be mowed and burned where practicable, and arrange to graze on fodder crops during the dangerous stage (late summer and early autumn). Adopt any method of management which will prevent the animals from eating the affected pasture.

POISONING BY POTATO TOPS.

The feeding of tops of the English potato to stock often results in poisoning. The poisonous principles are the alkaloids solanine and solanidine.

Symptoms.

Gradual and progressive sleepiness followed by coma with eyes staring and glassy.

Treatment.

Keep the animal as warm as possible by covering the body with a rug and attempt to rouse the animal by douching the head with cold water, slapping, shouting, &c.

Give stimulants such as brandy, whisky, ammonia, and follow with a purgative.

PHOTOSENSITISATION CAUSED BY CLOVERS.

Various clovers may produce a condition known as photosensitisation. Probably the worst offender is the Burr Trefoil (*Medicago denticulata*) commonly known as Burr Clover, an annual plant very abundant in Queensland during late winter and spring. The leaves are borne in three's at the end of a common leaf stalk and are toothed at their margins. The flowers are yellow and borne in small heads at the end of a flower stalk. The small flowers are followed by twisted, spiral pods armed with numerous spines with a minute hook at the end. The burrs or pods cling to clothing, the hair of animals, &c.

Symptoms.

Intense irritation of exposed skin or nonpigmented skin, i.e., skin covered by white hair. Swelling of such areas accompanied by a watery exudation and sloughing of skin.

Treatment.

Place affected animals out of direct sun's rays. Cover susceptible parts of animal with a mixture of crude oil (waste engine oil) and blacking as a protection against the sun.

HOVEN OR BLOAT.

A number of fodder plants, particularly the clovers and lucerne, are capable of causing hoven or bloat of ruminants, when succulent green material is ingested in fairly large quantity.

Symptoms.

Great distress. Suppression of rumination. Acute abdominal swelling of a tense and drum-like nature, particularly between the last rib and thigh. Breathing accelerated and laboured. Nostrils distended. Eyes staring.

Treatment.

Mild cases.—Exercise, with massage and kneading of the left side. If animal can swallow give one ounce of turpentine oil in one pint of raw linseed oil.

Severe cases.—Release pressure by passing a trocar and canula into rumen (paunch). Position of entrance of trocar and canula is in triangle between last rib, backbone, and first part of pelvis. It is necessary to secure the animal firmly before operation. The oil drench, as given above, or a mixture containing either a teaspoonful of lysol or Condy's crystals in a quart of warm water, is then poured into the rumen through the canula after the trocar has been withdrawn.

AUTUMN SPRAYING FOR CITRUS IN COSTAL AREAS.

Citrus growers in the coastal belt should now be making preparations for the autumn spraying against scale insects. Owing to adverse weather conditions little or no spraying was attempted in the spring. As a result infestation by scales in this region is more severe at present than would have been the case had the normal programme of scalicide application been carried out.

Pink wax scale is, of course, the dominant species. White wax is of importance in some orchards, while severe infestations of mussel scale have been observed on several occasions. As the lastnamed scale occurs on the fruit as well as on the leaves and woody parts of the tree its removal at this stage is particularly desirable.

The correct time for spray application is extremely important. Generally speaking, sprays should be directed against the young stages of the scales. The time will usually be determined by the behaviour of the dominant species, usually pink wax scale. With this insect sprays are best applied under normal conditions when the average young scale is about the size of a pin's head. Hatching is then reasonably complete, and further migration of young scales into the orchard from outside breeding sites is unlikely. Occasionally a protracted hatching occurs, and it may be necessary to delay spraying until a considerable number of the young scales are appreciably larger than a pin's head. Under no circumstances, however, should spraying be delayed until any significant percentage is twice that size.

If control operations are being directed against either of the two other species the time when the greatest number of young are present should be noted. Mussel scale breeds practically continuously and white wax scale has a rather protracted breeding period.

The resin-caustic-soda-fish oil spray is most useful at this time of the year. It is the only spray which gives satisfactory results against young pink wax scales appreciably larger than a pin's head or against well-grown mussel scale. Consequently it is the most efficient spray to use against pink wax scales when spraying has been delayed, either by protracted breeding or unsuitable weather conditions. It is also valuable when the control of both pink wax and mussel scales is required, as the optimum time for the control of these two species may not exactly coincide.

An oil-soap, soda spray may sometimes be used with advantage against pink wax scale associated with a light infestation of mussel scale. It is not as efficient as the resin-caustic-soda-fish oil against the latter scale, but it is much better than straight oil, which cannot be recommended unless young are present to the practical exclusion of other stages—a rather unlikely occurrence for this species. Of course, if pink wax is unaccompanied by any other species, and the hatching has been fairly even, soap-soda sprays alone may be used if applied at exactly the right time.

Excluding lemons, bearing trees which are carrying a considerable infestation of red scale will always be found to be in a poor state of health. They should receive cultural attention at once, for vigorously-growing trees do not normally suffer severely from the pest. If artificial control is necessary it should be established at this time of the year by the use of straight oil.

Are Our Seasons Changing?

N. J. KING.*

THE above question, frequently discussed amongst growers and others, influenced the writer to enquire into records for the Bundaberg area, with a view to finding an answer. Much of the credit for the large crops cut off the Woongarra and other soils in the early years of cane-farming is given to the favourable rainfall conditions then allegedly existing in the district.

It was found that rainfall figures from January, 1883, were available, and these are given in monthly precipitations from that date to December, 1935.

RAINFALL AT BUNDABERG POST OFFICE.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1883	752	461	126	128	307	0	29	109	30	352	24	191	2,509
1884	317	553	502	182	492	161	201	9	12	124	1,048	230	3,831
1885	237	288	343	46	194	595	4	38	515	48	119	490	2,917
1886	690	608	101	271	211	682	381	181	401	300	493	1,084	5,393
1887	706	1,152	1,336	674	42	29	527	512	440	64	611	371	6,464
1888	184	1,965	36	139	89	133	0	50	13	141	194	516	3,460
1889	77	224	783	891	398	58	757	247	179	76	545	561	4,796
1890	797	468	1,398	263	447	188	190	45	181	123	250	372	4,722
1891	774	72	249	389	367	1,331	152	297	126	217	311	795	5,080
1892	727	11	1,259	344	488	206	82	160	45	690	150	1,353	5,515
1893	2,270	3,210	965	223	207	1,479	186	420	52	89	156	31	9,288
1894	1,992	271	948	403	505	434	0	37	201	227	162	348	5,528
1895	2,280	731	79	459	150	1	204	10	304	174	265	1,106	5,770
1896	603	2,516	108	76	231	112	74	103	10	53	416	220	4,522
1897	547	343	392	30	248	174	792	51	333	464	111	588	4,073
1898	2,754	941	2,044	39	204	198	16	413	276	181	270	344	7,680
1899	1,131	726	376	413	292	142	233	262	167	160	6	762	4,670
1900	463	86	186	115	397	146	520	114	156	305	106	128	2,722
1901	234	261	317	1,027	114	74	201	559	180	218	128	0	3,313
1902	633	75	199	43	2	0	7	13	31	124	65	138	1,330
1903	97	260	605	38	1,155	33	598	88	355	43	325	997	4,594
1904	318	85	426	564	132	86	51	62	48	832	16	516	2,636
1905	1,667	217	335	631	426	110	71	17	95	237	95	674	4,575
1906	692	992	190	117	844	201	3	186	1,090	157	97	385	4,954
1907	329	390	1,281	38	308	449	87	43	0	170	290	299	3,684
1908	477	438	576	413	67	36	71	156	110	239	73	334	2,990
1909	652	370	506	154	67	151	565	166	98	41	355	299	3,424
1910	1,181	243	920	31	19	617	210	16	233	70	821	158	4,519
1911	2,105	975	431	246	56	0	37	115	0	236	130	298	4,629
1912	396	247	651	0	133	1,023	175	78	22	474	314	101	3,614
1913	4,575	429	673	501	531	345	126	2	152	18	183	522	8,057
1914	139	340	560	255	96	289	62	36	84	636	53	213	2,763
1915	386	1,281	7	44	182	58	103	131	28	80	108	312	2,720
1916	130	507	326	396	145	333	215	236	423	581	617	663	4,572
1917	907	846	1,071	199	184	4	22	114	354	239	648	302	4,888
1918	1,790	562	308	481	101	2	40	122	47	4	146	138	3,741
1919	16	322	537	153	655	13	0	48	0	228	63	5	2,038
1920	1,147	32	171	153	301	267	190	45	194	329	217	1,056	4,205
1921	741	72	338	881	204	448	288	885	35	80	168	1,614	4,954
1922	754	960	107	50	51	157	333	110	52	80	17	479	3,150
1923	822	48	48	660	0	410	90	80	180	34	134	378	2,884
1924	148	985	784	137	32	79	363	50	203	175	403	362	3,721
1925	1,366	596	570	56	59	792	45	102	57	61	129	645	4,478
1926	290	141	284	76	995	117	18	0	87	74	13	1,696	3,791
1927	2,580	530	926	383	18	326	106	122	100	301	528	584	6,604
1928	277	1,318	93	1,354	86	525	96	25	15	45	149	119	4,102
1929	421	1,073	249	725	31	336	4	39	18	239	238	624	3,997
1930	1,592	500	177	98	337	876	132	264	154	197	57	225	4,609
1931	279	2,377	691	134	439	117	64	90	83	147	349	944	5,714
1932	52	61	12	215	209	28	49	23	98	623	56	268	1,694
†1933	893	411	68	784	83	218	460	139	97	602	647	1,098	5,500
†1934	241	2,109	228	1,175	108	223	157	115	64	289	893	488	6,090
†1935	330	534	124	629	254	74	529	61	285	165	2	926	3,913

† Rainfall at Sugar Experiment Station.

* In "The Cane Growers' Quarterly Bulletin" (Bureau of Sugar Experiment Stations).

In considering these records it is noticed that if the total annual rainfall be averaged for each five years from 1883 to 1932 the following figures are obtained:—

Period.	inches.	Period.	inches.
1883–1887	42.21	1908–1912	38.35
1888–1892	47.15	1913–1917	46.00
1893–1897	58.16	1918–1922	36.18
1898–1902	39.43	1923–1927	42.96
1903–1907	40.89	1928–1932	40.23

The 1893 to 1897 period is abnormal on account of the 1893 flood year, when the rainfall totalled 92·88 inches. Similarly, if we take each ten-year period and separate the very dry from the very wet years, we arrive at the following:—

Period.	No. of Years under 30 inches rain.	No. of Years over 60 inches rain.
1883–1892	2	1
1893–1902	2	2
1903–1912	2	0
1913–1922	3	1
1923–1932	2	1

It must be obvious from these authentic records that the seasons have not changed radically since 1883. Reference to the table will show that the monthly incidence of rainfall is also much the same now as fifty years ago.

We are frequently reminded of the large crops then harvested as compared with the present-day production. An endeavour was made to obtain figures of cane tonnage per acre for the earlier years, but lack of records defeated this effort, and comparison with present-day acreage returns is therefore not possible. Some records for the whole of the sugar-producing area of the State are, however, obtainable since 1900, and these are shown in the accompanying graph (Plate 178).

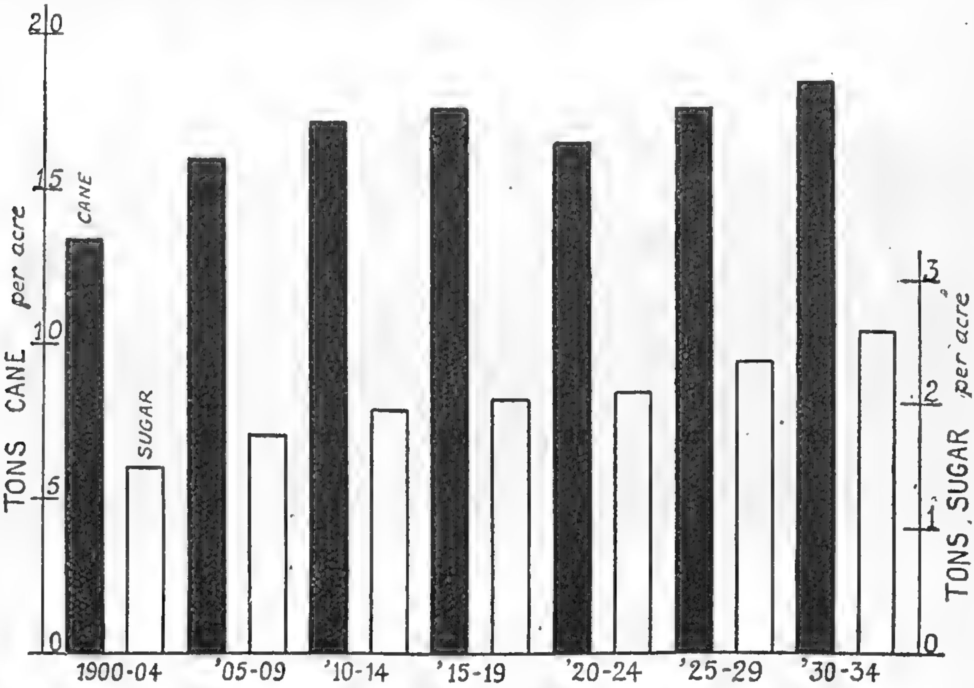


Plate 178.

Graph illustrating trends in cane and sugar production in Queensland.

This exhibits a definite upward trend of cane per acre since 1900. In seeking an explanation of the reputed large yields one can only conclude that during the first two or three years of cane-growing on new land occasional very large crops were harvested, but the reduction in crop returns must have been very marked after that period. Artificial fertilizers were not then used, and soil depletion would advance at a very rapid rate. What, then, was the reason for this decline in crop returns if seasons have not changed? It should not be forgotten that other major factors besides climatic ones were operating at that time. Firstly, the virgin nature of the soil with its ideal physical condition to a depth of many feet; secondly, the richness and fertility of that same soil after centuries of luxurious scrub growth, and the ultimate burning-off of the felled timber; thirdly, the natural subsoiling through the medium of the tree roots. The absence of implements in the early days kept the original soil under ideal conditions of tilth, and this condition existed for some years after farming began. It must also be remembered that mechanical planting was unknown as a farm practice, mechanical cultivation was not used, and the entire farm routine involved the use of far less implements than are utilized in recent times. All of these factors continued to keep the soil in a better state of tilth than exists at present; less soil packing then developed from implements, and plough and cultivation pans must have been virtually unknown.

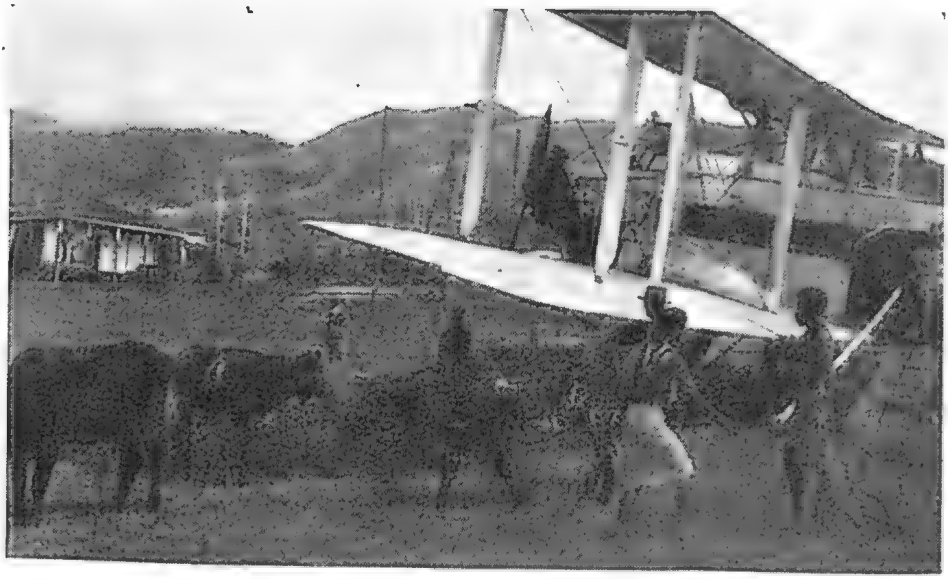


Plate 179.

DELIVERING DAIRY CATTLE BY AIR TRANSPORT, AUSTRALIAN MANDATED TERRITORY, NEW GUINEA.

Irrigation Waters of the Burdekin Delta.

N. G. CASSIDY.

THE underground water of the Burdekin delta is a subject of everyday interest, as well as of vital importance, to cane growers of the area. Many strange statements are made regarding the underlying drifts, and queer theories are often held as to the replenishment of them. Growers will, therefore, appreciate a short account of what is definitely known about the water-bearing beds and what conclusions can reasonably be drawn from a knowledge of the facts.

The gravel or sand "drifts" in which the water occurs cannot be mapped out in any simple way on account of the variety of conditions existing. At one particular spot a band of clay may separate streams which are shown by analysis to be quite unlike each other, and, contrary to expectation, the top supply may be more salty than the lower one. However, on proceeding from district to district, certain tendencies are evident, and it is possible to divide the area into three zones. The inland districts of Airedale, Maidavale, Pioneer, Dick's Bank, Klondyke, as well as most of Home Hill, comprise the first zone. The waters obtained under these districts have a "family" resemblance to one another, and are similar in composition to the flood waters of the Burdekin River. The second zone of the Delta is made up of the coastal districts, Seaforth, Rita Island, and lower Home Hill. Here the mineral content of the waters is much greater, and it is similar in type to that of sea water. The third zone is made up by the intermediary districts, McDesme, Ivanhoe, Kalamia, where the waters encountered have their own peculiarity of a high content of free alkali. The second and third zones thus yield less suitable irrigation waters than the first.

The evidence concerning the distribution of waters of different types gives a clue to the origin of the whole supply. It suggests that, in the main, replenishment of the supply takes place by flood waters moving along old river channels which have been covered up but are still very pervious to water. In the intermediate zone some obstruction to free flow of water occurs, and the water takes up considerable amounts of mineral matter. In the coastal districts sea-water penetrates the drifts in places, the connection between the two bodies of water being clear from the rise and fall of level which take place with the tides.

These conclusions are well supported by evidence of the rise in level of bores, subsequent to flooding in the river. The immediate response in the first zone of the area is contrasted with the lesser sensitiveness of bores situated elsewhere. Since neither the extent nor the time of the rise in level after rain is uniform, it follows that direct penetration of rainfall is not responsible for the renewal of underground supplies, particularly when the quality of the water is found to vary from district to district. It should be pointed out that the underground supplies could not possibly be derived from the sea, as the brine could not be removed by any natural process of filtration. Everything indicates that river flooding is the principal source of replenishment and, moreover, the evidence available does not point to any permanent depletion of the supply.

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* In the current "Cane Growers' Quarterly." Reprinted by courtesy of the Director, Bureau of Sugar Experiment Stations.

It is of interest to compare the quality of Burdekin waters with that of rivers and irrigation waters in other parts of the world. Such a comparison shows that Burdekin waters in general have an unfavourably low ratio of "hardness" to "salt." In other words the mineral matter of the waters contains too small a proportion of calcium, or "lime." This may cause grave damage in extreme cases, especially when regular water-logging of the soil is allowed to take place. Recent investigations show that even when the chemical action of salty water on the soil has only proceeded to 30 per cent. of the maximum extent possible, the soil has already suffered the maximum damage to its physical condition that it can undergo. All this illustrates the need for care in the use of the right kind and amount of irrigation water. A bad supply may possibly be improved by sinking deeper, or by lifting the spears. At all times of doubt a sample may be sent to the Bureau for analysis and for comparison with any previous tests. Except near the sea-coast any particular bore generally yields water of very constant quality from year to year.

For a fuller discussion of this subject growers may obtain, free, on application to the Bureau of Sugar Experiment Stations, Department of Agriculture and Stock, Brisbane, the original article published as Technical Communication No. 1 (1937).

LETTUCE-GROWING.

Lettuce is one of the most popular vegetables, and with regular sowing and care in cultivation it may be grown the whole year round. In Queensland the best times for planting are the late summer, autumn, and winter.

Lettuce is a vegetable that must be grown quickly to ensure crisp leaves. If a check is received during growth the leaves acquire a slightly bitter taste, which tends to decrease the market value of the plants. This defect is more prevalent during the late spring, early summer, and autumn plantings.

The soil must be well cultivated, and it is desirable that where possible large quantities of well-rotted farmyard manure be incorporated with the soil. Should fresh manure be used some time should elapse before planting.

Lettuce may be grown in a seed-bed and transplanted into rows, allowing 12 inches between the plants. The seed may also be sown directly into the row and the plants later thinned out to the required distance.

Sow the seed thinly and cover lightly with fine soil, and then firm the ground gently.

During the growing period the soil around the plants must be kept cultivated, but care must be taken not to allow any soil to get on or into the hearts of the plants. Constant watering is essential and the soil should never be allowed to dry out. Should the plants appear to be growing slowly an application of liquid manure would be beneficial, or, failing this, a top dressing of nitrate of soda or sulphate of ammonia at the rate of 1 to 2 cwt. per acre. These fertilizers should be spread lightly over the ground, but under no circumstances on the plants.

Lettuce should be marketed as soon as possible after cutting, as they deteriorate in quality very quickly.

The cabbage type of lettuce is the popular one in Queensland, and should be cut for market as soon as possible after hearting. For home use they may be used earlier.

Popular varieties for planting are:—

New York or Neapolitan.—A very large variety, best suited for planting in the cooler months.

Iceberg.—A large, good-hearting variety, with crinkled leaves and pink tips, suitable for summer planting.

A pamphlet on packing of lettuce for market is obtainable free on application to the Department of Agriculture and Stock.

The Tropics and Man

Radiation.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology, University of Queensland.

No. 5.

MEDICAL knowledge, just as any other branch of learning, has had to undergo a very gradual and painful development from the humblest beginnings. Many conditions which appear fairly well understood to-day were quite imperfectly understood a few years ago. This process of development is going on still at what appears to be an ever-increasing rate. There is this possible difference, however, that to-day man will admit a little more readily than he used to do, that he does not know or understand something. It is a natural impulse to conceal ignorance, and medical minds are just as human as others. A number of the effects of tropical residence were, until recent years, not properly understood, and were ascribed to such mysterious and mythical agencies as miasmata, lack of air, and so on. Many of these have been stripped of their camouflage and intrepid investigators deal with the most intimate details in the private lives of the malaria protozoon, the Weil's disease spirochaete, and the typhoid bacillus. The "debunking" of other mysterious influences, such as that of the radiations, and particularly the sun's radiations, is of more recent occurrence still, and so well ingrained are the old ideas that a hankering after the old superstitions is still widely manifest. Nevertheless, there is nothing mysterious about these radiations, and they can be dissected and classified with greater ease than the more popularly recognised organisms.

Radiations at Home.

The first family of radiations is that of the *wireless waves.* As far as we know, they have no effect upon the human body (until transformed into crooning or speeches), which is just as well in this wireless era.

The next family is a very extensive one, often divided into three parts for convenience, although one would be hard put to it to say where one part begins and another ends. The longest chaps in this family are the *heat or infra-red rays.* When they fall upon the human eye they do not excite it to vision, but they do affect a photographic plate, a fact which has recently revolutionised aerial photography. When they fall upon the body they are absorbed and give rise to increased temperature of the part they fall upon. (A glowing fire of red coals often heats more than a blazing fire.)

The medium-sized chaps are the *light waves.* They also affect a photographic plate, but more rapidly than the heat waves. They too tend to raise the body temperature, but not nearly so much. The light waves, particularly the shortest ones, have another property, that of burning the skin. Their outstanding property, of course, is that of exciting the eye and producing the sensation of sight.

The smallest chaps in this family are the *ultra-violet waves.* Their chief properties are those of affecting photographic plates, and of burning the skin. They are not visible and give rise to very little heat in the body. They are somewhat peculiar amongst radiation in being able to penetrate only the tiniest way into the skin, but in this distance they can do a lot of damage, as anyone with bad sunburn will testify.

The third family of radiation is that of *X-rays and radium rays.* These are very short, but penetrate the body very well, affect photographic plates and produce burning in the part of the body upon which they fall.

The last family is that of the *cosmic rays.* About these we know very little, but so badly did Professor Picard want to know more about them, that he engineered the first strato-sphere balloon ascent—truly an epic adventure—to measure and investigate them before they got lost in the world's atmosphere.

Radiation in the Tropics.

Introductions have now been effected, and, as is usually the case with introductions, you are probably very little the wiser. However, you are spared the embarrassment of asking them their names, since you can look back surreptitiously now and then, to refresh your memory. You have met them at home; now see them at work.

The first family of wireless waves and the third family of X-rays we can ignore since they are artificial and not specially active in the tropics. The last family of cosmic rays may turn out to be of importance, but they are so aloof, that, in spite of their mysterious and intriguing character, we cannot say anything very definite about their incidence or possible effect in the tropics. There is, so far, nothing to indicate that they have any special effect in the tropics.

The important family is, therefore, that large and complex second one. There is no doubt that the total amount of this radiation received in the tropics is greater than that occurring in greater latitudes. We need nothing to tell us that the heat is greater, and one is quite prepared to believe that the light is more intense. It is popularly supposed, and I for one believed it until shown otherwise, that the ultra-violet radiations in the tropics are much more intense. No wide survey has been made of ultra-violet light in the tropics, but some very careful estimations made on the African coast have shown that the ultra-violet radiation there is no greater than that in the German countryside. Why this is so is not fully understood, but it is generally accepted that the high humidity of the atmosphere absorbs these radiations as they pass through it on their way from the sun to the earth. On a clear day in the hot desert, ultra-violet radiation is almost certainly high, but on a dusty day, the greater proportion of it is absorbed by the dust in the air.

Effects of Tropical Radiation.

A dear lady once solemnly assured me that the sun on the southern side of Port Said was very different, and in some mysterious way much more malignant than on the north side of Port Said—a matter of a hundred miles at the most. Some fifteen years ago in Malaya, it was the custom for children to be kept indoors until three or four in the

afternoon with windows shuttered *and topees on*, as though some solar hobgoblin were darting about seeking some forgotten and tortuous path of attack. (That is completely altered now, with great benefit to the children.)

It seems reasonably clear that there is nothing mysterious about tropical radiations. They are the same radiations as occur in temperate countries, but some of them are more intense. The effects of this increased intensity of radiations are as follows:—

1. Sunburn readily occurs through the agency of the light and ultra-violet rays. Wind, rain, and blowing sand materially aggravate the effects of sunburn.

2. There seems to be a definite tendency to more frequent occurrence of rodent ulcers and skin cancers on the exposed parts, particularly in the fair-skinned type of person who does not go brown. Chronic irritation of any description is a well-known cause of cancer, and it is highly probable that the constant irritation of sunburn in these people acts as the stimulus.

3. A condition known as "glare asthenopia" is very common, and again, is said to be commoner in blue-eyed persons. There is tenderness of the eyes, inability to stand any kind of a glare, and frequent intense headaches.

4. Cataract is rather common in the tropics, but diet probably plays an important part there.

5. "Heat effects." These are the most important effects. They include heat exhaustion, heat hyperpyrexia, and heat cramps. They are all due to interference with the necessary loss of heat from the body as described in earlier articles. Heat radiations may participate directly in this interference or light rays may join in by giving rise to heat when absorbed by the skin. The actual part exposed to these radiations may be a little hotter than the rest of the body, but usually the heat created locally by these radiations is quickly carried all over the body and helps to raise the general body temperature.

You will notice that I have said nothing about "sun-stroke." This was the name given to all sorts of sudden collapse occurring in people who happened to be exposed to the sun at or about the time of the collapse. It was supposed to be due to a mysterious effect of the sunlight falling upon the head and neck. We now know that the causes of these cases of collapse were very varied—malaria, alcoholism, heat exhaustion, hyperpyrexia, &c., and such cases can occur just as readily in hot mines, where no sunlight exists. Sun-stroke is no longer a suitable medical term. As a matter of fact, the most intense sunlight falling on the head and neck will produce very little, if any, rise in temperature of the brain above that of the body in general, which was the supposed mechanism at work. In a later article I hope to deal a little more fully with these effects of heat. Next time I propose to run over some of the other atmospheric conditions which may have an effect upon man or have been blamed for certain effects at different times.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of March, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Morden Pansy 2nd	R. Mears, Morden Farm, Toogoolawah	9,585·25	411·918	George of Nestles
	JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.			
Fairy Bower Shamrock	E. O. Jeynes, Raceview	12,455·06	511·781	Blacklands Peer
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Mabreen Heartease II.	F. G. Haldane, Wolvi, Gympie	8,771·25	333·994	Springdale Surprise
Mabreen Princess	F. G. Haldane, Wolvi, Gympie	8,731·6	313·038	Numbawarra Headlight
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Sunnyview Thelma (365 days)	J. Phillips, Sunnyview, Wondai	16,411·45	702·2	Lovely's Commodore of Burradale
College Stately 4th	Queensland Agricultural High School and College, Gatton	10,420·78	407·643	College Robin
Morden Nora 14th	R. Mears, Morden Farm, Toogoolawah	9,172·00	373·45	Jupiter of Morden
College Stately 6th	Queensland Agricultural High School and College, Gatton	8,320·08	352·308	College Robin
Rocklyn Colleen	T. A. Strain, Wondai	8,090·95	305·662	Oakvilla Champion's Prince
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Rocklyn Connie	T. A. Strain, Wondai	6,257·95	260·833	Kurrajong Reddie's Beau
	JERSEY.			
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Oxford Best's Dolly	S. H. Caldwell, Walker's Creek, *via* Bell	5,205·91	266·055	Oxford Best
Wyreen Cress	J. B. Keys, Gowrie Little Plain	5,595·86	371·497	Lyndhurst Majesty

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Wild Millet.

W.L.S. (Komine, Q.)—

The specimen represents the wild millet, *Echinochloa crusgalli*, a fairly common grass in most warm-temperate countries. It is represented in Queensland by a number of forms. The one you send occurs mostly as a weed of cultivation or growing in damp places, rather than in the ordinary pasture. It is very closely allied to such well-known cultivated fodders as Japanese millet and white panicum. Seed is not stocked by nurserymen, but where it grows Japanese millet can be grown for the same purpose, namely green feed for dairy cattle.

Water Weeds in Reservoirs.

K.M.C. (Winton)—

Most of the weeds in earthern tanks are algae and the drying and scraping of the sides would have no effect on these. The usual method of ridding tanks of submerged water weeds is using copper sulphate, which may be put into a coarse sack and dragged backwards and forwards from the bank until it it is all dissolved.

To be safe for drinking purposes the copper sulphate must not exceed one part in a million parts of water by weight, that is, 1 lb. to every 100,000 gallons of water. You probably know the contents of your tank and so could calculate the quantity of copper sulphate required. As it is a poison, of course it must not be made too strong. The usual practice is to make an application and then a second in about a fortnight's time.

Water Couch.

E.G.T. (Dawson Valley)—

Your specimen represents the water couch, *Paspalum distichum*, a very common grass in Queensland, and, away from the coast, generally found in melonhole country, or along the banks of creeks and in similar wet situations. In such situations it is a very valuable grass, has a high fodder value, and is much relished by stock. It is a native grass, but is widely spread over most warm temperate and sub-tropical countries. It is easily spread by roots and is probably introduced into fresh localities by water fowl.

"Mackie's Pest."

L.B.S.R. (Mirriwinni, via Babinda)—

The grass is *Chrysopogon aciculatus*, a grass widely spread over the tropical regions of the world, and known in North Queensland as grass seed, or Mackie's pest. The seeds are apt to produce irritating sores, which may last for months.

We think the only way of dealing with the grass would be to plant the school play-ground with some grass of a more smothering nature, and would try any of the following:—

(1) Kikuyu.

(2) Para grass, or giant couch. This is often known in North Queensland as *Panicum muticum*.

(3) Buffalo grass.

All these grasses are grown from cuttings, and the land would have to be dug over, before planting, as they do best in ground that has been worked. Roots of all three should be obtainable at Cairns.

Wild Sorghum.

J.B.A. (Radford)—

The grass is *Sorghum verticilliflorum*, commonly known as wild sorghum, a native of South Africa now very common as a naturalised weed in Queensland, particularly along roadsides, railway embankments, or, in fact, anywhere where the ground has been disturbed. As you know, most of the sorghums possess a prussic-acid yielding glucoside and must be regarded as dangerous. The present species is one of the worst in this respect, and if fed to stock caution should be observed in not letting them gorge themselves on it on an empty stomach, and preferably the grass should be cut and allowed to wilt before being fed to stock.

Plants from the Mid-west Identified.

A.C.McA. (Drillham)—

1. *Dichanthium sericeum*, blue grass; one of the best of the native grasses.
2. *Cyperus fulvus*, a sedge, not a true grass.
3. *Panicum Buncei*, a native panic grass. Most of the native panic grasses are very useful in the average mixed native pasture.
4. *Sporobolus Berteroanus*, Parramatta grass or rat's tail grass, generally regarded as a grass of very poor quality.
5. *Brachiaria piligera*, an excellent pasture and hay grass. Although a native grass generally seen in old cultivation lands, or in places where the ground has been broken, rather than in the ordinary pasture.
6. Seed heads required for determination.
7. *Aristida leptopoda*, a 3-pronged spear grass. On the whole, 3-pronged spear grasses are of poor quality, but this is the best of the species, and makes a fair amount of bottom feed suitable for sheep.
8. *Sporobolus pallidus*, sometimes called fairy grass. A very short-lived grass during the summer months; probably useful in the mixed native pasture, but not of any particular merit.
9. *Eragrostis cilianensis*, stink grass. This grass mostly occurs as a weed of cultivation, although in some places it has run out into the ordinary pasture. Generally speaking it is not touched by stock, although we have heard that stock will sometimes eat it in the form of hay.
10. *Tragus racemosus*, small burr grass.
11. *Aristida personata*, a wire grass or 3-pronged spear grass.
12. *Dactyloctenium radulans*, button grass. A short-lived summer grass, but an excellent fodder both for sheep and cattle, very much relished both in the green stage and when dried.
13. *Cyperus gracilis*, a sedge, not a true grass.
14. Looks like *Digitaria marginata*, ordinary summer grass, but seed heads are required to be certain.

In reply to your query as to how to keep your collection, grasses look very well if pressed flat between sheets of newspaper for some little time and then mounted with gum strips on to thick paper or thin cardboard. The name should be attached and a few notes on the properties of the grass, where collected and the date. If you prefer it, the grasses could be made up into small sheaves and tie-on labels attached.

Vigna lanceolata.

A.C.G. (Cambooya)—

The specimen represents *Vigna lanceolata*, a native plant for which we have not heard a common name. It belongs to the same genus as cultivated cowpea, and is generally regarded as an excellent fodder. It becomes rather a pest in cultivation, owing to its habit of rooting very deeply, and parts of its underground system, when broken, being capable of sending out new shoots and forming new plants. No really satisfactory method of getting rid of it in cultivation, other than keeping the green growth down, is known.

French Millet.

W.E.J. (Mundubbera)—

The specimen is French millet, *Panicum miliaceum.* This grass is not known to be poisonous or harmful at any stage of its growth, although it has gone out of favour of recent years as a green food, as compared with other millets such as Japanese millet and white panicum. The seed of French millet is a common ingredient of mixed birdseed.

Lawn Grasses and Hedge Plants in Western Queensland.

A.F.H. (Longreach)—

Buffalo Grass (*Stnotaphium secundatum*). On the whole, experience has shown this to be perhaps the best all-round lawn grass for Western Queensland. It is rather hard grass to cut, and must be kept fairly short, but seems to stand the western conditions much better than other lawn grasses.

Couch Grass (*Cynodon dactylon*). There are some quite good lawns of this grass in Western Queensland, and in most western towns where there is a bowling green, the sward is composed of this grass.

Blue Couch (*Digitaria didactyla*). We do not remember seeing any lawns of this grass in the West, and are inclined to think it would be rather soft for the purpose, unless water is plentiful.

Roots of the three grasses may be obtained through any nursery channel.

Blue couch and buffalo grass are grown from roots only, but the common couch is sometimes grown from seed.

Water or Swamp Couch (*Paspalum distichum*). We have had no experience with this grass as a lawn grass. It is a great pest in cultivation, and has overrun some of the cultivation paddocks at the Farm School, St. Lucia, near Brisbane.

Regarding plants for hedge-making, here are some suggestions:—

Vitex trifolia variegata. We have seen some splendid hedges of this in the far West.

Common Olive (*Olea Europeae*). The common olive is sometimes used as a hedge in the southern States, but we do not remember seeing any hedge of it in Queensland, although we have seen a very beautiful avenue of it. We should think the objection to it would be that it would be rather slow growing.

Cypress Pine. Horizontal *Cyperus, Cupressus lambertiana horizontalis,* is the best of all the cypresses for making hedges. We think it would do quite well at Longreach, but do not remember seeing any hedges of it, or individual trees in the Central West.

Oleander. The oleanders make quite suitable plants for hedges, but it is sometimes difficult to get them leafy right to the base. As you know, they can be had in various colours. There is one rather showy species with a variegated leaf.

Hibiscus. These shrubs make quite good hedges, but it is sometimes difficult to get them leafy right down to the base.

Tecoma capensis. This makes quite a good hedge, particularly for a high hedge, say 8 to 10 feet, in which case it flowers profusely. When in bloom, with its red, tubular flowers, it is rather a showy sight.

Guinea Grass. Blue Panic.

R.C. (Mundubbera)—

1. *Panicum mamimum,* Guinea grass. This grass occurs in several forms in Queensland. The one sent by you has been distributed under the name of green panic, or green panicum, and this particular form is an excellent grass, without the coarse, hard stems, commonly developed by the ordinary type of Guinea grass. It is well worth growing for fodder, but is only suitable for cultivated areas. A small paddock of it would be, however, an excellent stand-by to any dairyman.

2. *Panicum antidotale,* blue panic. This grass has been widely advertised as a fodder. It is fairly drought-resistant, but is more a grass for growing in small cultivation paddocks rather than in the ordinary pasture. As such, it would be an excellent stand-by. The stems are rather caney, but they have the habit of sending out tufts here and there along their length, and these tufts provide a good bulk of leaf foliage for stock, particularly cattle.

General Notes

Staff Changes and Appointments.

The following transfers of inspectors of stock, slaughterhouses, and dairies in the Department of Agriculture and Stock have been approved:—Messrs. R. J. O'Sullivan from Allora to Killarney, J. Cattanach from Beaudesert to Allora, and P. McCallum from Brisbane to Gladstone.

Mr. J. P. Lee, Court House, Mossman, has been appointed Chairman of the Mossman Local Sugar Cane Prices Board—vice Mr. T. W. Foran, transferred—and also an Agent of the Central Sugar Cane Prices Board for the purpose of making enquiries under Section 5 (2A) of the Regulation of Sugar Cane Prices Acts in regard to sales and leases of assigned lands.

Constable D. C. McQuaker, Proserpine, has been appointed also an inspector under the Brands Acts.

Mr. C. E. Ellis, District Inspector of Stock, Warwick, has been appointed also District Inspector of Brands.

Mr. K. D. Hoffmann, Inspector, Diseases in Plants Acts, and Banana Agent, has been transferred from Nambour to Dayboro'.

Mr. C. E. Scott, Brookfield, Yeulba, has been appointed Acting Inspector of Stock at The Canal Dip, Yeulba.

Mr. G. Johnson, Mia Mia, via Mirani, has been appointed millowners' representative on the North Eton Local Sugar Cane Prices Board, vice Mr. S. H. Scougall, resigned.

Mr. R. L. Hunter, Freshwater, Cairns, has been appointed an honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. A. E. Beak, manager of Salisbury Plains Station, Bowen, has been appointed an Honorary Ranger under the Animals and Birds Acts.

Arrowroot Board.

Nominations in connection with the election of five growers' representatives on the Arrowroot Board have been received at the Department of Agriculture and Stock from Messrs. Robert Stewart, Ormeau; Carl Brumm, Woolgoolba; Alexander Rose, Norwell; George R. Walker, Upper Coomera; and Leslie R. Oxenford, Oxenford.

The first four mentioned persons are at present members of the Board, Mr. J. F. Cassidy, the other member, did not renominate for this election. The new Board will be appointed for a further term of three years.

Animals and Birds Sanctuary at Coalstoun Lakes.

The National Park Reserve R. 94, Coalstoun Lakes, via Biggenden, has been declared a sanctuary under the Animals and Birds Acts, and it will be an offence to take or kill any animal or bird in this Reserve. Messrs. R. W. Martin and H. G. Bundock, of Coalstoun Lakes, have been appointed honorary rangers in connection with the sanctuary.

Grade Standards for Cavendish Bananas.

An amending regulation has been approved under "*The Fruit and Vegetables Acts*, 1927 *to* 1935," providing for an alteration in the "Standard" grade of the new grades "Standard" and "Large" for Cavendish bananas which were approved last month. The minimum length for "Standard" grade Cavendish bananas shall be six inches instead of six and one-half inches.

Sugar Levy Regulation.

A regulation passed in March under the Primary Producers' Organisation and Marketing Acts empowered the Queensland Cane Growers' Council to make a particular levy at the rate of one-halfpenny per ton of sugar-cane harvested during the coming season, such to be expended on matters of an economic, legal, or compensatory nature where such matters are of vital importance to the sugar industry.

The time for the receipt of a petition for a poll on the question of whether or not the levy should be made was set down as the 19th April, but an amending regulation extends the date for the receipt of such a petition until the 17th May, 1937.

Rural Topics

Border Line Cream.

Every factory manager must formulate a policy in regard to the lowest quality cream that can be manufactured into choice quality butter at his particular factory. Modern methods of manufacture and factory equipment have done much to enable the utilisation of cream which a few years ago would have been discarded. Nevertheless, the dairying industry still offers no exception to the general rule—that the quality of raw materials directly influences the character of the manufactured product. The addition of a few faulty cans of cream to a vat may thus cause the spoilage of otherwise choice quality butter. Only a thorough knowledge of the origin and nature of a given defect can help in determining the fate of doubtful cream.

There is a limit to the capability of machinery and manufacturing technique to offset defects in cream quality, and no factory can afford to slur over defects in the cream received. Any laxity in this respect is really doing the farmer a disservice, for he may remain unaware that better quality cream is required, and takes less, instead of more care on the farm.

First quality butter can only be obtained when the farmer realises that the remedy for cream defects is essentially his responsibility.

Seasonal Notes for Wheat Areas.

As a result of the recent rains the surface mulch has probably been destroyed on most of the early well-worked fallows intended for wheat, and will, of necessity, have to be restored by further cultivation. Weed growth will also require early destruction in order to avoid depletion of the moisture reserves in the soil.

The land should not be worked to a greater depth than 4 inches. Wheat requires a firm seed-bed for its successful development. Deep cultivation is consequently not essential, and if attempted at this time of the year may adversely affect the prospective crop, more particularly if it is intended solely for grain.

Deep working may also bring to the surface weed seeds lying dormant in the soil. These may germinate with the wheat, and actively compete with the crop.

When ordering seed purchasers should state whether the wheat is required for early or late sowing. This is essential, because early wheats, such as Florence and Seaspray, are suitable for late sowing. Late varieties, such as Currawa, Cleveland, Warren, and Ford, are slow maturing types adapted for early sowing.

Prairie Grass Seed.

Large quantities of prairie grass seed are now being purchased by stock-owners in anticipation of early sowings. It is well known that commercial prairie grass seed is not of uniform quality, and when purchasers of this seed are not certain of the germinating capacity of the seed bought, samples should be submitted to the Department of Agriculture and Stock for examination. Samples should be addressed to "The Officer-in-charge, Seed Laboratory, Department of Agriculture and Stock, Brisbane," and will be examined free of charge provided that following particulars are written in ink on the packet containing the sample:—

(1) The name under which the seed was purchased;
(2) The number of bags from which the sample was drawn, and the number of bags in the whole consignment;
(3) The marks of identification, if any, on such bags;
(4) The name and address of the sender, with date of sampling;
(5) The name and address of the sender's supplier, with date of delivery.

The usefulness of prairie grass for grazing and seed production purposes has been seriously impaired by the widespread occurrence of smut in the seedheads. Tests carried out by the Department of Agriculture and Stock have shown that the disease may be controlled by treating the seed before sowing with a mercury dust or with formalin solution. The mercury dust (Abavit B or Ceresan) should be applied at the rate of 3 oz. for every 20 lb. of prairie grass seed. The dust and seed should be thoroughly mixed by rotating together in a closed container. If a mercury dust is unobtainable the seed, on the day prior to sowing, should be spread out on a smooth floor or tarpaulin, and sprinkled with a formalin solution made up by adding 1 pint of commercial (40 per cent.) formalin to 30 gallons of water. About a gallon is required for each bushel of seed to be treated. The seed should be thoroughly moistened, covered with moist bags, and left overnight.

Orchard Notes

JUNE.

THE COASTAL DISTRICTS.

THE remarks that have appeared in these notes for the past two months apply in a great measure to June as well, as the advice that has been given regarding the handling, grading, packing, and marketing of the citrus crop still holds good. As the weather gets cooler the losses due to the ravages of fruit flies will decrease. The absence of flies does not, however, permit of any relaxation in the care that must be taken with the fruit, even though there may be many less injured fruit, owing to the absence of fruit-fly punctures, as there is always a percentage of damaged fruit which is liable to blue mould infection, which must be picked out from all consignments before they are sent to the Southern States if a satisfactory return is to be expected. If the weather is dry, citrus orchards must be kept in a good state of tilth and any winter green manure crops turned under, otherwise the trees may get a setback. Old worn-out trees may be dug out and burnt; be sure, however, to see that they *are* worn out, as many an old and apparently useless tree can be brought round and made to bear good crops, provided the trunk and main roots are still sound, even though the top of the tree is more or less dead. The whole of the top of the tree should be cut off and only the trunk and such sound main limbs left as are required to make a new head. The earth should be taken away from around the collar of the tree, and the main roots exposed, any dead roots being cut away and removed. The whole of the tree above ground and the main roots should then be dressed with a strong lime sulphur wash or Bordeaux paste. The main roots should be exposed for some time, not opened up and filled in at once. Custard apples will be ripening more slowly as the nights get colder. If the weather becomes unduly cold, or if immature fruit is sent South, the fruit is apt to turn black and be of no value. This can easily be overcome by subjecting the fruit to artificial heat, as is done in the case of bananas, during the cooler part of the year, when it will ripen up properly and develop its flavour. Grade custard apples carefully, and pack in cases holding a single layer of fruit only for the Southern markets.

Pineapples, when at all likely to be injured by frost, should be protected by a thin covering of bush hay or similar material. The plantation should be kept well worked and free from weeds. The fruit takes longer to mature at this time of the year; consequently it can be allowed to remain on the plant till partly coloured before gathering for the Southern markets, or can be fully coloured for local use.

Banana plantations must be kept worked and free from weeds, especially if the weather is dry, as a severe check to the plants now means small fruit later on. Bananas should be allowed to become full before the fruit is cut, as they will carry all right at this time of the year; in fact there is more danger of their being injured by cold when passing through New England by train than there is of their ripening up too quickly.

Bear in mind the advice given with regard to the handling, grading, and packing of the fruit. It will pay you to do so. Land intended for planting with bananas or pineapples during the spring should be got ready now.

Strawberries require constant attention, and unless there is a regular and abundant rainfall, they should be watered regularly. In fact, in normal seasons an adequate supply of water is essential, as the plants soon suffer from dry weather or strong, cold westerly winds. Where not already done, vineyards should be cleaned up ready for pruning—it is, however, too early to prune or to plant out new vineyards.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

All kinds of deciduous fruit trees are now ready for pruning, and this is the principal work of the month in the orchards of the Granite Belt area. Don't be frightened to thin out young trees properly, or to cut back hard—many good trees are ruined by insufficient or bad pruning during the first three years. If you do not know how to prune, do not touch your trees, but get practical advice and instructions from one or other of the Departmental officers stationed in the district. In old orchards, do not have too much bearing wood; cut out severely, especially in the case of peaches, or you are likely to get a quantity of small unsaleable fruit. There are far too many useless and unprofitable fruit trees in the Granite Belt area, which are nothing more or less than breeding-grounds for pests, such as fruit-fly, and are a menace to the district. Now is the time to get rid of them. If such trees are old and worn-out, take them out and burn them, but if they are still vigorous, cut all the tops off and work them over with better varieties in the coming season—apples by grafting in spring and peaches and other stone fruits by budding on to young growth in summer. Planting can start now where the land is ready and the trees are to hand, as early-planted trees become well established before spring, and thus get a good start. Be very careful what you plant. Stick to varieties of proved merit, and few at that, and give so-called novelties and inferior sorts a wide berth. Take the advice of old growers, and do not waste time experimenting with sorts that have probably been tested in the district, and turned down years ago. When land is intended for planting this season, see that it is well prepared and well sweetened before the trees are put in, as young trees seldom make a good start when planted in sour and badly prepared land.

Slowly acting manures—such as bonedust, meatworks manure, or island phosphates—can be applied now, as they are not liable to be washed out of the soil, and they will be available for the use of the trees when they start growth in spring. Lime can also be applied where required. Badly drained land should be attended to, as no fruit trees will thrive with stagnant water lying round their roots.

On the Downs and Tableland all kinds of fruit trees can be pruned now, and vines can be pruned also in any district where there is no danger from late frosts, and where this can be done the prunings should be gathered and burnt, and the vineyards ploughed up and well worked to reduce the soil to a good state of tilth, so that should rain come it will absorb all that falls and the moisture can be kept in the soil by cultivation subsequently.

Citrus fruits will be at their best in the western districts. The trees should be watered if they show signs of distress; otherwise all that is necessary is to keep the surface of the land well worked. All main-crop lemons should be cut by this time, as if allowed to remain longer on the tree, they only become overgrown and are more suitable for the manufacture of peel, whereas if cut and cased now they will keep in good order so that they can be used during the hot weather.

RECORD WEIGHT LITTER.

A remarkably good performance was made by the litter of twelve Wessex Saddleback pigs owned by Mr. R. Turpin, Lowood, which was officially weighed at eight weeks old by the Department of Agriculture and Stock. The total litter weight of 624½ lb. at eight weeks old is the heaviest yet recorded by this Department.

Litter Record.

Owner.—R. Turpin, Pensilva Stud, Lowood.

Dam of Litter.—Pensilva Ace 3rd., Wessex Saddleback.

Sire of Litter.—Long Park Champion (imp.), Wessex Saddleback.

Litter Born On.—8th February, 1937.

Total Litter Weight at Eight Weeks.—624½ lb.

Average Weight per Pig at Eight Weeks.—52 lb.

Farm Notes

JUNE.

FIELD.—Winter has set in, and frosts will already have been experienced in some of the more exposed districts of the Maranoa and Darling Downs. Hence insect pests will to a great extent cease from troubling, and weeds will also be no serious drawback to cultivation. Wheat sowing should now be in full swing, and in connection with this important operation should be emphasised the necessity of at all times treating seed wheat by means of fungicides prior to sowing. Full directions for "pickling" wheat by copper carbonate treatment are available on application to the Department of Agriculture, Brisbane. Land intended for the production of early summer crops may now receive its preliminary preparation, and every opportunity taken advantage of to conserve moisture in the form of rainfall where experienced; more particularly so where it is intended to plant potatoes or early maize. Where frosts are not to be feared the planting of potatoes may take place in mid-July; but August is the recognised month for this operation. Arrowroot will be nearly ready for digging, but we would not advise taking up the bulbs until the frosts of July have occurred. Take up sweet potatoes, yams, and ginger. Should there be a heavy crop, and consequently a glut in the market, sweet potatoes may be kept by storing them under cover and in a cool place in dry sand, taking care that they are thoroughly ripe before digging. The ripeness may be known by the milky juice of a broken tuber remaining white when dry. Should the juice turn dark, the potato is unripe and will rot or dry up and shrivel in the sand pit. Before pitting, spread the tubers out in a dry barn, or in the open if the weather be fine. In pitting them or storing them in hills, lay them on a thick layer of sand; then pour dry sand over them till all the crevices are filled and a layer of sand is formed above them; then put down another layer of tubers, and repeat the process until the hill is of the requisite size, and finally cover with either straw or fresh hay. The sand excludes the air, and the potatoes will keep right through the winter. In tropical Queensland the bulk of the coffee crop should be off by the end of July. Yams may be unearthed. Sugar-cane cutting may be commenced. Keep the cultivator moving amongst the pineapples. Gather all ripe bananas.

Cotton crops are now fast approaching the final stage of harvesting. Growers are advised that all bales and bags should be legibly branded with the owners' initials. In this matter the consignor is usually most careless, causing much delay and trouble in identifying parcels, which are frequently received minus address labels.

SHEEP LAND FOR SELECTION AT CUNNAMULLA.

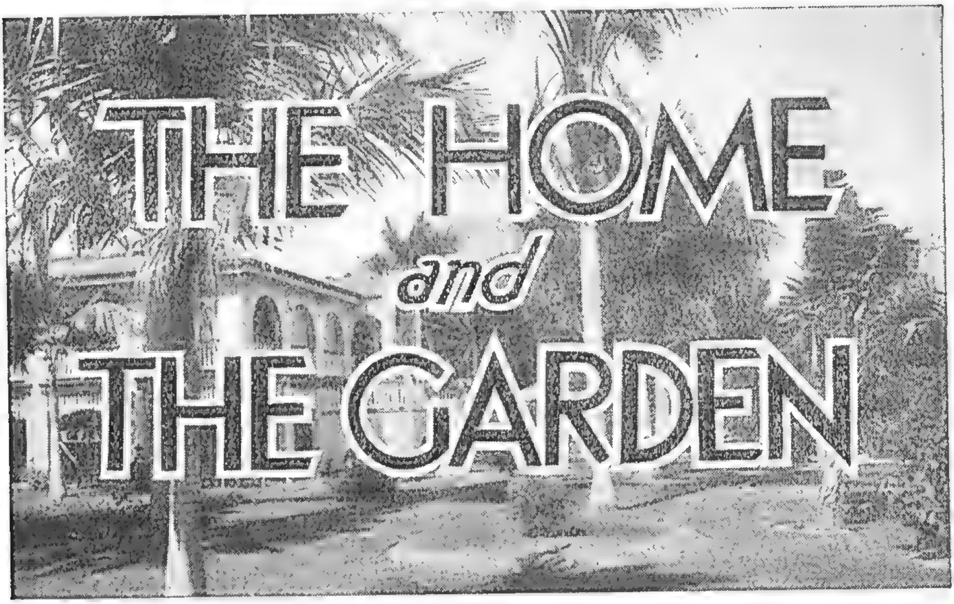
Portion 6, parish of Jumna, comprising part of the resumption from Charlotte Plains Holding, situated about 25 miles east from Cunnamulla, will be open for Grazing Homestead Selection at the Land Office, Cunnamulla, on Monday, 10th May, 1937, at 11 a.m. The area of the portion is 21,000 acres.

The selection will be for a term of 28 years, and the annual rent for the first seven (7) years will be 2¾d. per acre.

The selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years, and must be enclosed with a rabbit-proof fence during the same period.

The land is well shaded and is good breeding and fattening country. It is watered by two bore drains, but additional water will be required.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agent at Cunnamulla, and the Government Tourist Bureaux, Sydney and Melbourne.



OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

MALNUTRITION.

IT is unfortunately true that slight degrees of malnutrition pass unnoticed in very many little children. Nobody thinks very much about the children who are simply a bit "below par." It is most important that parents and others should know the signs indicating that a child is malnourished, and should be alert to seek advice and apply it at once.

SIGNS OF UNDER-NOURISHMENT.

An under-nourished child is usually below the standard weight for his age and height.

He does not gain in weight as he should, and is more or less soft and flabby.

His appetite is usually poor or erratic, and he is "finicky" about his food, habitually refusing certain articles of diet—usually some of those necessary for good health—milk or vegetables, for instance.

He gets tired easily, is inclined to be listless, has dark rings under his eyes, and stands badly.

He is more or less fretful and nervous, and "whiney" without apparent cause.

He lacks that indefinable air of joyous elasticity and buoyancy which is characteristic of the perfectly healthy small child.

It cannot be over-emphasised that the child who drifts along through the pre-school period in this condition enters the rough-and-tumble and the competition of school life *handicapped*. Unless something

is done to remove the causes of his poor condition the chances are that he will emerge from school days still handicapped for the battle of adult life.

Is your child "below par?" If so, parents should ask themselves these questions:—

What are the child's food habits?

Does he eat good, wholesome food suitable for his age? Does he "chew" it properly? Does he have three good meals a day only, or does he have sweeties and pieces between meals? Are meal times cheerful, happy times?

What are his habits generally?

Are the bowels regular or is he constipated? Does he have regular rest and sleep? Is proper cleanliness of body and teeth observed?

Does he get over-fatigued?

Are his activities too stimulating and too continuous? Does he have to walk beyond his powers?

Is he happy—"blithe, bonny, good, and gay"?

Is the home atmosphere such that personality as well as body may develop freely?

Has he any physical defects—decayed teeth, adenoids, ear or eye troubles, etc.?

Earnest examination of the child's habits and environment rarely fails to reveal the cause or causes of malnutrition. Regular periodical inspection by a trained person is the greatest possible help and protection to the health of the pre-school child.

IN THE FARM KITCHEN.

WAYS OF USING LEFT-OVER MEAT.

Potato Bridies.

Take 4 oz. scraps of cold meat, ¼ gill stock or gravy, 1 level teaspoonful flour, salt and pepper.

Mix the flour, seasoning, and stock. Bring them to the boil and add the finely minced meat. Re-heat the mixture and turn it out to cool.

Make a potato paste by kneading one level tablespoonful of flour with a little salt into each heaped tablespoonful of finely mashed potato, and when smooth roll it out thinly. Cut the paste into rounds, about the diameter of a breakfast cup. Put a little of the meat mixture into each round, damp the edges, fold over the paste, and fix the edges securely together. Fry them in deep, hot fat.

Bengal Mince.

Take 4 oz. rice, 2 oz. butter, ½ lb. onions, 10 oz. cold meat, 2½ gills stock or gravy, 3 teaspoonfuls curry-powder, 1¼ oz. flour, seasoning.

Wash the rice and cook it in boiling water until tender, then drain it in a colander. Pour cold water through to separate the grains, and drain it again. Peel and mince the onions, fry them until slightly browned in the butter. Lift out half of them and put them into a saucepan. Stir two teaspoonfuls of curry-powder into the remaining onions and butter, and, when blended, add the rice and make it hot. Add a teaspoonful of curry-powder to the onions in the saucepan, cook them a minute, then add the stock (or gravy) and stir in the flour, smoothed in a little water. Boil for a few minutes, then mince the meat and add it. Season the mince and make it hot; if not brown enough add a few drops of browning. Heap the prepared rice in the centre of a hot dish, pour the mince round it, and garnish with sippets of toast. If the mince is too thick thin it down with a little more stock.

Meat Mould.

Take 10 oz. cold meat, 1½ oz. breadcrumbs, 1 small onion, 2 eggs, salt, pepper, and stock (if required).

Peel and finely chop the onion and fry for a few minutes, then strain off the fat. Boil one egg for about fifteen minutes, until hard, then remove the shell and chop up the egg finely. Mince the meat and mix with the onion and chopped egg. Make the breadcrumbs and add. Season well to taste and mix all well together. Beat up the remaining egg and bind the prepared ingredients. If any more moisture is needed a little stock may be added, but the mixture should be quite stiff. Put into a well-greased mould or pie-dish, pressing it down firmly. Cover with a greased paper and bake in a moderately hot oven for about thirty-five minutes. Turn out carefully and serve cold. If the meat is all lean, add a little melted butter to the mixture, in which case no stock would be needed. This is an excellent method of using up cold meat, more especially if the latter is rather underdone. Slices of the meat mould put between bread and butter will make tasty sandwiches.

Venetian Minced Beef.

Take 2 onions, ¾ oz. flour, ¼ lb. spaghetti, ½ pint stock (more if required), 1 small tin peeled tomatoes, 10 oz. cold beef, seasoning, butter, or dripping.

Peel and mince the onions, and fry them gently till golden in a little hot fat. Then pour off the fat that remains. Add the stock, and stir in the flour, smoothed in a little water. Bring it to the boil, and boil for two or three minutes, add a little browning as required. Meanwhile, cook the spaghetti in a pan of slightly boiling water. When it is tender drain it, and return it to the pan with the liquor drained from the tin of tomatoes. Simmer gently for a few minutes. Add the drained tomatoes to the gravy. Mince the meat and add it, together with seasoning to taste. Make the mixture thoroughly hot, turn it on to a dish, and serve it with a border of the prepared spaghetti.

Beef Rolys.

Take 3 oz. cold beef, 6 oz. cold potato, 1 dessertspoonful minced onion, 2 or 3 dessertspoonfuls thick tomato sauce, pepper and salt, ¼ lb. of short or flaky pastry.

Put the meat and potato through the mincer and mix them with the onion. Season to taste and moisten the mixture with tomato sauce. Divide it into eight portions and form each into a sausage shape. Roll out the pastry fairly thinly, and cut oblong-shaped pieces, the same width as the rolls and long enough to reach round them.

Windsor Croquettes.

Take ¾ lb. cold meat, 1 egg-yolk, ½ small onion, 1 level tablespoonful bread-crumbs, ½ oz. flour, ½ oz. butter, 1 gill stock, pepper, salt, crushed herbs, Worcester sauce.

Melt a tablespoonful of butter in a saucepan, add an equal quantity of flour, stir it till it is frothy, then thin it down to a thick sauce with any meat stock. Keep stirring till the sauce boils. Then mince the meat finely. Beef, lamb, mutton, pork, veal, or chicken are all equally good for croquettes. Add the minced meat to the sauce. Season it well with pepper and salt, Worcester sauce, minced onion, and crushed herbs to taste. Stir in the crumbs and egg-yolk. When well blended spread the mixture on a plate, and when it is quite cold shape it into croquettes. Coat each one with egg and breadcrumbs and fry in a pan of hot, smoking fat.

Beef Rechauffe.

Take ½ lb. cold beef, 1 small tin peeled tomatoes, 2 onions, 1 teaspoonful flour, 1½ lb. mashed potatoes, seasoning, milk, 1 or 2 fresh tomatoes, margarine.

Peel and mince the onions, put them in a saucepan with a little fat, and cook them until tender and just lightly coloured. Draw the pan aside and drain off the fat. Add the contents of a small tin of peeled tomatoes and thicken the mixture with the flour, smoothed in a spoonful of water. Boil it for a few minutes, keeping it stirred, then take off the gas and let it cool. Boil the potatoes in the usual way and mash them. Season with pepper, add a lump of margarine, and moisten with a little milk. Put a thin layer of the mashed potato in the bottom of a fireproof dish, which has been well buttered. Mince the beef and mix it with the tomato and onion, season it and turn it into the dish, then heap the remainder of the potatoes on top to form a border. Put the rechauffe into the oven and make it hot. Garnish the centre with quarters of lightly baked fresh tomato, and serve immediately.

Mould of Lamb.

Take some cold lamb, 1 level teaspoonful salt, 1 cupful finely shredded cabbage, 1 tablespoonful lemon juice, 1 hard-boiled egg, ½ oz. gelatine, ½ pint water, 2 dessert-spoonfuls castor sugar, ½ gill vinegar, 1½ pimentoes (tinned), 1 tablespoonful cooked peas.

Dissolve the gelatine in hot water and add the lemon juice to it, with the sugar, salt, and vinegar. Strain it and leave to cool. When it is beginning to stiffen add the chopped pimentoes, cabbage, peas, and slices of egg. Turn it into a wet mould and allow it to set. Turn the jelly out on to a dish lined with lettuce leaves. Border with overlapping slices of lamb and more lettuce leaves. Serve with tomatoes and mayonnaise.

Beehive Pudding.

Take 3 oz. macaroni, 1 cupful breadcrumbs, 1 cupful cold meat (chopped), 1 sliced tomato, 1 egg, salt, pepper, ½ oz. flour, 1 oz. butter, ½ gill milk, tomato sauce.

Put the macaroni and salt into a pan of boiling water. Boil it for thirty minutes and strain it. Let the macaroni cool. Grease a basin and sprinkle bread-crumbs over the inside. Line the basin round and round with long pieces of macaroni, pressing it against the basin and adding a few breadcrumbs to make it keep in place. Fry the tomato in the butter for five minutes, and stir in the flour and chopped meat. Season to taste and add the rest of the breadcrumbs and macaroni. Bind with the beaten egg and milk, and fill the basin with the mixture. Cover with greased paper and steam for one hour. Leave for five minutes. Turn out carefully and serve with tomato sauce.

Tomato Sauce.

Take 1 lb. tomatoes, ½ onion, 1 bayleaf, 1 oz. butter, 1 oz. flour, ¾ gill water, pepper and salt.

Peel and chop the onion and slice the tomatoes. Melt the butter, put in the onion, bayleaf, and tomatoes, and simmer very gently for twenty minutes. Rub the sauce through a sieve. Mix the flour smoothly with the water. Put it with the tomatoes in a saucepan and stir till boiling. Boil for five minutes and season with pepper and salt.

POINTS FOR BEEKEEPERS.

In most beekeeping localities there are several nectar flows during the season, and at the termination of each flow there is a tendency for the bees to commence robbing each others' hives of their stores. Great care should be taken not to leave honey or pieces of comb lying about where bees can obtain access to them, nor should hives be left open longer than is necessary.

It is usually at the termination of the last nectar flow of the season that attempts by the bees to rob each other's stores are most marked, and attempts are then made to open hives for the purpose of extracting the last honey. The disturbance is sometimes so great that further work becomes impossible. At such times bees will enter the honey-house in thousands should the door have been inadvertently left open, and even the kitchen at home will be invaded if open vessels of honey be left exposed. When this happens the first thought is to close the door, but it is not to be recommended. It is far better to go inside and cut off the supply, and to see that all tanks, super-bodies, and tins are closed and made absolutely bee-proof. When all honey and other sweets are safe leave the honey-house door open until every bee is satisfied that there is nothing to be gained by going in. It takes a day for them to realise this, so that when darkness falls the honey-house should be closed.

If it is imperative that extraction should proceed the beekeeper should use a bee-escape fitted to a thin board the full size of the hive. On one side of the board slats are nailed to slightly raise the super from the brood chamber. A hole corresponding to the one on the escape is then bored through the centre of the board and the escape tacked over it. The bee-escape should be placed below the honey super, and the bees will pass through the escape to the brood nest below but are unable to return, and if the escapes are placed on the hives in the evening the supers may be removed practically free of bees early the next morning, and may be quickly carried to the extracting house without causing excitement among the other bees. It is useless, however, to attempt using a bee-escape if any brood is present in the honey super, as the bees will not leave.—H. HACKER, Apiary Inspector.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MARCH IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and Stations.	Average Rainfall. Mar. 1936.	Average Rainfall. No. of Years' Records.	Total Rainfall. Mar. 1937.	Total Rainfall. Mar. 1936.
	In.		In.	In.
North Coast.				
Atherton	8·76	36	7·45	10·36
Cairns	18·10	55	15·80	12·76
Cardwell	15·62	65	32·23	21·16
Cooktown	15·26	61	17·75	14·48
Herberton	7·76	51	6·38	11·16
Ingham	15·69	45	33·74	28·51
Innisfail	26·33	56	48·99	24·96
Mossman Mill	18·08	24	19·98	19·39
Townsville	7·16	66	9·74	9·44
Central Coast.				
Ayr	6·42	50	9·63	12·33
Bowen	5·76	66	6·98	26·16
Charters Towers	3·71	55	6·30	7·33
Mackay	11·93	66	21·19	31·53
Proserpine	12·15	34	24·88	35·56
St. Lawrence	5·11	66	10·59	4·47
South Coast.				
Biggenden	3·65	38	14·95	4·06
Bundaberg	4·97	54	16·60	8·45
Brisbane	5·60	85	7·26	5·96
Caboolture	7·44	50	9·15	10·93
Childers	4·33	42	17·95	6·43
Crohamhurst	10·93	44	14·17	18·80
Esk	4·58	50	9·38	4·28
Gayndah	2·96	66	5·36	2·49
Gympie	6·03	67	16·87	7·83
Kilkivan	3·75	58	9·82	5·17
Maryborough	5·76	66	13·03	5·32
Nambour	8·99	41	19·77	14·34
Nanango	3·27	55	6·74	3·76
Rockhampton	4·31	66	7·37	5·10
Woodford	7·68	50	8·67	12·25

Divisions and Stations.	Average Rainfall. Mar. 1936.	Average Rainfall. No. of Years' Records.	Total Rainfall. Mar. 1937.	Total Rainfall. Mar. 1936.
	In.		In.	In.
Central Highlands.				
Clermont	3·06	66	4·06	8·52
Gindie	2·56	38	..	7·85
Springsure	2·87	68	3·64	5·55
Darling Downs.				
Dalby	2·61	67	6·92	4·04
Emu Vale	2·22	41	4·11	1·70
Hermitage	1·95	31	..	1·38
Jimbour	2·43	49	4·96	2·63
Miles	2·60	52	6·79	5·15
Stanthorpe	2·59	64	4·52	4·47
Toowoomba	3·62	65	9·84	3·68
Warwick	2·41	72	6·94	1·92
Maranoa.				
Roma	2·56	63	7·32	7·05
State Farms, &c.				
Bungeworgorai	1·39	22	..	6·98
Gatton College	3·03	38	7·12	2·84
Kairi	7·88	21	..	11·63
Mackay Sugar Experiment Station	10·93	40	18·03	36·97

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—MARCH, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure Means at 9 a.m.	Shade Temperature. Means. Max.	Means. Min.	Extremes. Max.	Date.	Extremes. Min.	Date.	Rainfall. Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·78	86	75	92	15	71	25	1,775	22
Herberton	..	78	64	83	19	56	29	638	15
Rockhampton	29·92	86	70	93	28	65	30	737	10
Brisbane	30·01	82	66	97	28	63	4	726	12
Darling Downs.									
Dalby	29·99	84	60	92	28	46	30	692	6
Stanthorpe	..	76	54	87	27	40	29	452	8
Toowoomba	..	78	58	90	28	56	30	984	6
Mid-Interior.									
Georgetown	29·82	89	69	94	8	60	30	1,079	10
Longreach	29·89	90	66	97	28	57	30	609	5
Mitchell	29·97	84	59	92	27, 28	43	30	426	4
Western									
Burketown	29·79	91	74	96	7, 29	66	17	229	4
Boulia	29·84	93	70	101	1, 8	58	29	108	2
Thargomindah	29·94	91	67	103	27	56	29	4	1

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	May. 1937.		June. 1937.		MOONRISE. May. 1937.	MOONRISE. June. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6.18	5·20	6.37	5·2	9.39	11·11
2	6·18	5·19	6·37	5·2	10·29	—
						a.m.
3	6·19	5·18	6·38	5·2	11·24	12·10
4	6·20	5·17	6·38	5·2	..	1·9
					a.m.	
5	6·20	5·17	6·39	5·2	12·22	2·11
6	6·21	5·16	6·39	5·2	1.20	3·18
7	6·21	5·15	6·39	5·2	2·20	4·25
8	6·22	5·14	6·40	5·2	3·23	5·35
9	6·23	5·14	6·40	5·3	4·31	6·39
10	6·23	5·13	6·40	5·3	5·39	7·42
11	6·24	5·12	6·41	5·3	6·50	8·36
12	6·24	5·11	6·41	5·3	7·59	9·23
13	6·25	5·11	6·41	5·3	9·3	10.6
14	6·26	5·10	6·42	5·3	10·3	10·44
15	6·26	5·10	6·42	5·3	10·47	11·25
16	6·27	5·9	6·42	5·3	11·31	11·51
					p.m.	p.m.
17	6·27	5·9	6·43	5·4	12·10	12·25
18	6·28	5·8	6·43	5·4	12·45	1·0
19	6·29	5·8	6·43	5·4	1·18	1·35
20	6·29	5·7	6·43	5·4	1·50	2·14
21	6·30	5·7	6·44	5·4	2·23	2·54
22	9·31	5·6	6·44	5·4	2·58	3·40
23	6·31	5·6	6·44	5·4	3·36	4·29
24	6·32	5·5	6·44	5·4	4·14	5·23
25	6·32	5·5	6·44	5·5	4·56	6·18
26	6·33	5·4	6·45	5·5	5·44	7·13
27	6·34	5·4	6·45	5·5	6·34	8.9
28	6.34	5·3	6·45	5·5	7·27	9·6
29	6·35	5·3	6·45	5·5	8·23	10·4
30	6·35	5·2	6·45	5·5	9·19	11·1
31	6·36	5·2			10·15	

Phases of the Moon, Occultations, &c.

4th May.	☽	Last Quarter	4 36	a.m.
10th ,,	●	New Moon	11 17	p.m.
17th ,,	☾	First Quarter	4 49	p.m.
25th ,,	○	Full Moon	5 38	p.m.

Perigee, 11th May, at 4 a.m.
Apogee, 24th May, at 11 p.m.

On the 19th Mars will be in opposition to the Sun, rising as the Sun sets. Having moved with retrograde motion since 21st April it will again be seen near the head of the Scorpion as on that date.

On the 23rd Mercury will be stationary. Having apparently moved westward in Aries since the beginning of the month it will then resume its eastward course.

Neptune, in Leo, near the border of Virgo, will become stationary on the 28th. The remote planet, only visible in a telescope, might seem uninteresting to the ordinary observer were it not for the romantic story of its discovery by two young scientists simultaneously, and unknown to each other, Adams in England, and Leverrier in France, not by actual observation but by intricate calculation at their study table. That was in 1845, and then it was found that Adams' calculations differed by one degree only from those of Leverrier. Soon afterwards Dr. Galle in Berlin discovered the planet by observation only a few degrees from the position in Aquarius indicated by Leverrier—and Neptune had wandered into the empty space shown on the famous star maps of Berlin.

Mercury rises at 7.26 a.m., 1 hour 8 minutes after the Sun, and sets at 6.2 p.m., 42 minutes after it on the 1st; on the 15th it rises at 6.0 a.m., 26 minutes before the Sun, and sets at 4.54 p.m., 16 minutes before it.

Venus rises at 4.52 a.m., 1 hour 26 minutes before the Sun, and sets at 4.6 p.m., 1 hour 14 minutes before it on the 1st; on the 15th it rises at 3.52 a.m., 2 hours 34 minutes before the Sun, and sets at 3.20 p.m., 1 hour 50 minutes before it.

Mar rises at 6.31 p.m. and sets at 8.19 a.m. on the 1st; on the 15th it rises at 5.17 p.m. and sets at 7.11 a.m.

Jupiter rises at 10.19 p.m. and sets at 12.9 p.m. on the 1st; on the 15th it rises at 9.24 p.m. and sets at 11.18 a.m.

Saturn rises at 3.17 a.m. and sets at 3.31 p.m. on the 1st; on the 15th it rises at 2.27 a.m. and sets at 2.41 p.m.

The Southern Cross will be visible soon after sunset and until it fades in the approaching daylight.

2 June	☽	Last Quarter	3 24	a.m.
9 ,,	●	New Moon	6 43	a.m.
16 ,,	☾	First Quarter	5 3	a.m.
24 ,,	○	Full Moon	9 0	a.m.

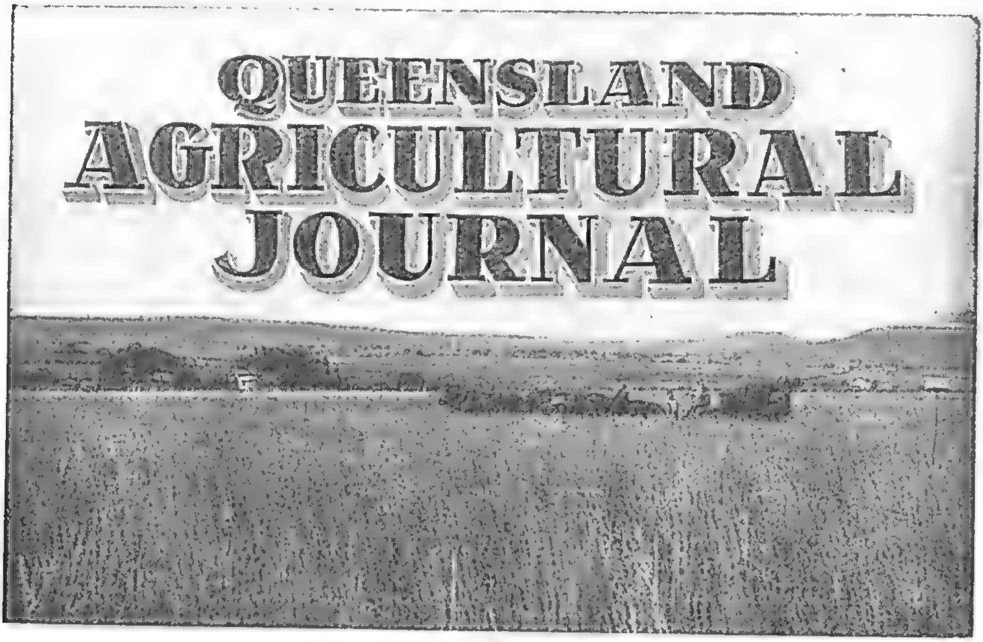
For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling**, members of Agricultural Societies, **Five Shillings**, including postage. General Public, **Ten shillings**, including postage.



VOL. XLVIII. 1 JUNE, 1937. PART 6

Event and Comment

Progressive Departmental Policy.

ADDRESSING a recent field-day gathering at Nambour, the Minister for Agriculture and Stock (Hon. Frank W. Bulcock) remarked that the large assemblage of fruitgrowers was impressive evidence of a very keen interest in orchard problems in Queensland. Referring to the series of field demonstrations that had been arranged for the occasion by officers of his Department, the Minister said that it was only by such means and the provision of experimental plots that the application of science to agriculture could be demonstrated in a practical way. What was being done at the present time was of advantage to both the individual and the State generally. The Department of Agriculture had pursued a progressive policy as well as an economic one. The Maroochy district had a fascination for him, the region containing possibilities that were not found in any other part of the State. His officers were zealous and keen and anxious to advance their work in the interests of agriculture in Queensland. The Department formed a triple alliance in which the Minister, the officers, and the producers each played their essential part.

Continuing, the Minister said that new possibilities were being opened up on the economic side of agriculture. The object was to make agriculture a much more agreeable occupation, and to make it as efficient as possible. In every primary industry the scientific aspect was given

greater consideration than ever. The remarkable efficiency of the Queensland sugar industry was an outstanding example of the value of science in primary production.

Supporting Mr. Bulcock's remarks, Mr. H. F. Walker, M.L.A., said that the Department of Agriculture, of which he was a former Minister, was conducted on a high plane of efficiency. He considered that the field days and the demonstrations given on experimental plots were of great benefit to the pineapple or any other industry, and the more the scientific side was encouraged the greater would be the development of all phases of their primary industries.

Mr. F. Nicklin, M.L.A., also spoke in commendatory terms of the work of officers of the Department. Great interest, he said, had been taken in the field demonstrations, from which growers were receiving untold advantages. Much had been achieved by the adoption of scientific methods in the cultivation of the pineapple, and this was all pointing to the importance of producing a better article for canning and the home market.

Dealing with marketing, Mr. Nicklin said the idea was to improve the quality of the pack wherever possible. The Department's efforts along these lines were bearing fruit already. In a marketing policy they needed the growers' wholehearted support, and anything that was done should be for the general advancement of the growers and the industry.

Loyalty to Co-operative Organisations.

IN the course of his address to the fruitgrowers at Nambour, Mr. Bulcock spoke of the necessity of primary producers remaining loyal to their organisations. The responsibility for their success or failure, he said, rested on individual members, and it was the duty of everyone to pull his weight. Any man selling outside his commodity board or outside the Committee of Direction might do quite well for a time, but eventually it tended to break up the scheme and the advantages of stabilised marketing.

Mr. Bulcock added that the pineapple-growers were now required to make important decisions, in the formulation of a scheme in connection with their industry through their sectional group committees and the Committee of Direction. In connection with any decision that the growers themselves might make it would be wise to see that they were wholehearted in any project undertaken, and before they embarked on any scheme in respect to the matter of canned pineapples they should be satisfied it was economically sound. He could assure them that as Minister every consideration would be given to a scheme with which the growers were unanimous. Whatever action was taken to protect economic interests he would be happy to assist as long as it was calculated to help the industry. He, however, urged strongly on the growers to discuss thoroughly and examine any proposition which was put forward, and when they had arrived at a decision to stand loyally by it. If they intended to venture into a new phase of the industry it would be necessary to investigate it from all angles. When they were satisfied that they had arrived at a stage of unanimity they could then approach the Government, which would give effect to it, if found practicable.

Fodder and Water Conservation.

SPEAKING at an annual agricultural show function at Wondai in the course of the month, Mr. Bulcock made an important announcement on the subject of fodder and water conservation. He said, *inter alia:*—

"There is a growing consciousness of the importance of the part agriculture plays in the general scheme of things, and the value of science as the handmaid of agriculture . . . . Industries must be prepared to make contributions towards their own advancement. . . . The problems of agriculture may be divided into three phases—cultivation or production, scientific, and the marketing or economic phase. At one time production was the only problem, markets being automatic. The next phase was the scientific, and until the post-war period the economic and marketing phase had not been considered.

"We talk of progress, but we are only on the fringe of agriculture in Australia. We should make greater effort to prevent loss; our scientific knowledge is not sufficiently applied to agriculture. The recent drought in the coastal and semi-coastal areas of the State resulted in a loss of £5,000,000 to the people of Queensland, and the pastoral areas had previously suffered tremendous losses through drought. I have no time for those who say that such losses are non-preventible.

"We should aim to each year reduce our economic loss. In dairying, among other problems, we have that of the low quality product. The sooner such problems are faced, the greater the results—but there must be the fullest co-operation among all concerned. How can we do it?

"I have on my table probably a hundred schemes for the conservation of water and fodder. I have appointed a committee to investigate and, after they obtain correct answers to a questionnaire, I will convene a conference of all the interests concerned. This is a national matter, and all from the National Government to individual primary producers will need to co-operate; if such is done, a scheme which is worthwhile will be brought about. I will not admit that no one has the capacity to evolve such schemes to release from the major difficulties which beset it, agriculture, which should not be the vassal of other industries.

"Why should it be represented that there is any disparity between the social standing of those engaged in other industries and those engaged in the most skilful occupation of agriculture? Cheap newspapers delight in depicting 'Dad and Dave,' and legislation to eliminate such misrepresentations might even be warranted.

"The time is not far distant when I will be giving very active consideration to the problems of conservation of water and fodder. These coastal and semi-coastal areas must be enabled to produce not only their own fodder requirements, but also those of the western areas. I believe a practical policy can be enunciated. Why should Queensland almost every year purchase large quantities of fodder from the southern States?

"We have the lands with capacity for enormous production of fodder; all we lack is regularity of water supply, and on such regularity depends the advancement of agriculture in Queensland. I desire to bring to fruition schemes for conservation of water and of fodder, and that is also the desire of the Premier. I hope to be able to introduce in next session of Parliament legislation on such lines and calculated to be a material factor in advancing the State's agricultural prosperity."

Seedling Pests of Cotton and Their Control.

W. J. S. SLOAN, B.Sc. Agr., Assistant Entomologist.

SPRING is a critical period for the cotton-grower, as failure to obtain a reasonable stand at this time of the year may greatly prejudice the success of the crop.

In young cotton, insect pests may impede the growth of the plant, produce a malformed bush, or totally destroy the seedlings. If seedling destruction is extensive, partial or complete replanting is then necessary, with a consequent loss of time and money. As some weeks may elapse before suitable rains permit replanting, the cotton may be unable to set an early crop of bolls. An early setting is desirable in order to minimise the adverse effects of possible subsequent unfavourable climatic conditions and further insect outbreaks.

The main pests associated with young cotton include cutworms, false wireworms, aphids, thrips, Jassids, grasshoppers, flea beetles, and corn ear worms. Larvæ of the cotton web-spinner may also cause considerable damage in some of the cotton-growing areas.

Cutworms are cosmopolitan pests which injure many different crops. The cutworm attacking cotton is the larva of a dark-brown moth,* and is a typical greyish-green or greyish-brown caterpillar, which grows up to an inch and a-half in length, and feeds at night both on the leaves and stem of the seedling. Trouble from this pest may be due to a migration from hosts outside the field or from weeds in the field itself.

The false wireworm is the larva of a beetle† which is a third to half an inch in length, is dark-grey in colour, and has longitudinally ribbed wings. The larva is thin, brown, shiny, and hard, and grows to an inch in length. Both adults and young may attack cotton seeds and seedlings. In the latter case, the larvæ attack the soft stem under the ground surface, while the adults injure the seedling by ringbarking it at or just above ground level.

The cotton aphid‡ is a small, soft-bodied insect usually living in colonies on the plant. The cream coloured immature forms are wingless but greenish-black winged adults occur in the colonies and are comparatively numerous during the autumn months. This insect appears on seedlings every season to a greater or lesser extent, and feeds mostly on the lower surface of the leaves. The foliage is distorted, and sometimes the central shoot may be killed, forcing the growth into two or more main branches—an undesirable feature in the cotton plant.

The cotton thrips§ is a small creamy-white insect which causes distortion of the leaves and main shoots. In heavily-infested seedlings the entire terminal bud may frequently be destroyed, and the plant makes no progress beyond the production of two thick seed leaves. Injured leaves usually show a silvered appearance on the under surface. This pest thrives on a variety of weeds—e.g., pigweeds and thistle, commonly found in cotton fields.

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* *Euxoa radians* Guen.

† *Dasus macleayi* Blk.

‡ *Aphis gossypii* Glov.

§ *Thrips tabaci* Lind.

The cotton-leaf hoppers or Jassids* are small, active, fly-like insects. There appear to be two or three species involved, a greenish winged form predominating. Infested plants show malformation of the leaves similar to that caused by the thrips and the cotton aphid. Heavy infestation may kill the foliage and sometimes the entire seedling if the weather is dry and soil moisture is low.

Grasshoppers damaging cotton seedlings belong to several species, and farmers are familiar with their main characteristics. The most troublesome are firstly a brown insect† which grows up to an inch and a-half in length, and secondly a large brown-winged species‡ which attains a length of approximately three inches, and has the immature stages prettily marked with yellow and brown patches. Both these grasshoppers are fond of weed hosts botanically related to cotton. The larger grasshopper is particularly common in softwood scrub areas.

The cotton flea beetles§ are small brown to black insects which derive their name from the nimble way in which they spring off a plant when disturbed. They feed on the web of the leaf, destroy buds, and sometimes chew into leaf petioles and the stem. Like the grasshoppers, they show a strong liking for native host plants which are allied to cotton.

The corn ear worm is the larva of a stout-bodied moth.‖ The moth has a wing expanse of about 1½ inches, the forewings being a reddish-pink, and the hind wings creamy-yellow with broad marginal areas of a smoky colour. When mature, the larva is about 1½ inches long. The colour of the larva varies considerably, shades of red, brown, yellow, and green being found in different individuals. The colours are arranged in stripes along the length of the body, adjacent bands being separated by irregular white lines just above the legs and along the back.

Damage from this pest may occur from migrations off host plants within and without the cotton field. The pest breeds on many plants, including maize, lucerne, pigweeds, bullhead, hogweed, thistles, wild gooseberry, and ragweed. Badly prepared land usually has patches of weeds on which the pest may breed. Cultivation of the cotton after the seedlings are up kills the weeds and leaves the pest no alternative but to attack the cotton.

Cotton paddocks, though themselves free of weeds, frequently suffer severe injury from invading swarms of corn ear worms. In this case the pest has bred up on nearby host plants, and when disturbed for some reason, they migrate rapidly in all directions. Should a cotton field be in the path of migration, the seedlings may be severely injured.

Corn ear worms injure the seedling by defoliating it, injuring the stem to cause a malformal bush, or entirely destroying it.

Unlike the above-mentioned pests which usually occur in some degree each season, the cotton web-spinner¶ is only occasionally destructive. The moth is small, inconspicuous, and brown to fawn in colour. The larva is a light to dark-green coloured caterpillar, which spins a web

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* *Empoasca* spp.

† *Phaulacridium gemini* Sjöst.

‡ *Valanga irregularis* Walk.

§ *Nisotra breweri* Baily, and *N. submetallica* Blk.

‖ *Heliothis obsoleta* Gn.

¶ *Loxostege affinitalis* Led.

profusely to form protecting tunnels. Fully matured, it is about three-quarters of an inch long. The female moth lays her eggs on many types of plants, including Noogoora and Bathurst burrs, certain weeds allied botanically to cotton, roly-poly, and the creeping saltbush. When the larvæ have consumed the readily available food supply, migration takes place. Occasionally cotton fields are close to the breeding centres and become infested by migrant larvæ. Leaves may be skeletonised, terminal buds eaten out, and the seedlings killed. Attacked plants are fouled with frass-cluttered webbing.

Control Measures.

Cotton crops grown in Central Queensland are very prone to corn-ear worm attacks between January and April, as the weather is then very favourable for the rapid multiplication of the pest. As maturing cotton suffers less than younger plants, late-planted crops are invariably more severely attacked. Early planting is therefore desirable, and land should be prepared in good time to enable the farmer to take advantage of any planting rains in September and October, for conditions will usually be suitable then for rapid seed germination and development. Failure to do so considerably increases the danger of crop losses by insect pests.

The over-wintering stages of most insects require an appropriately moist and warm environment before adult emergence is possible. These adults require fresh host plants on which to breed. Even spring rains, which are insufficient to allow planting on prepared land, stimulate the general emergence of the over-wintering insects. These insects will lack suitable hosts, and neither they nor their progeny will survive very long. Hence, though early sowing is generally desirable, it can be assumed that when inadequate rainfall delays planting beyond October, conditions are unsuitable for an early increase in the pest population. Under these special circumstances, late planted crops may escape serious infestation.

Most pests of seedling cotton breed on various weeds, many of which germinate and grow rapidly with the late winter and spring rains. It is therefore essential to keep both fields and headlands clear of weeds for at least a month before planting. Cutworm attacks are particularly common in seedling cotton grown on sandy soils in which this precaution has not been taken. It is a most undesirable practice to plough, harrow, and plant practically in one operation, especially if the land is carrying a growth of weeds. In some years such a procedure may be quite successful, but in ordinary seasons, any cutworms present on the weeds may survive and later attack the cotton seedlings soon after they germinate.

If possible, cotton should not be planted close to weedy fields or paddocks growing maize, lucerne, and tomatoes. Many weeds and the three crops mentioned often carry heavy populations of the corn-ear worm, and lucerne occasionally may have, in addition, larvæ of the cotton web-spinner. Should the pest larvæ migrate from any of these hosts, the nearby cotton may be severely damaged before suitable control measures can be applied.

Old cultivation paddocks should not be abandoned to weeds. The volunteer growth which is liable to breed cotton pests can be suppressed at very little cost by establishing a Rhodes grass pasture.

Higher seed rates than are necessary to produce a normal stand of cotton should be used, for it is easier to thin out excess plants than to replant depleted stands. Losses from false wireworm can usually be avoided in this way, for sufficient plants survive to give a reasonable crop.

For the control of invading swarms of caterpillars, both the molasses-lead arsenate swabbing mixture and the usual cutworm bait are useful.

The swabbing mixture is prepared according to the following formula:—lead arsenate, 1 lb.; molasses, 1 gallon; water, 6 gallons. The lead arsenate and molasses are first thoroughly mixed in separate containers with small quantities of water. They are then added to each other, and the whole made up to 6 gallons, the mixture being thoroughly stirred. The fluid so prepared is flipped on to plants in both the infested rows and a number in front of the swarm with a white-wash brush or a bundle of straw.

Freshly cut weed hosts, such as pigweeds and hogweed, dipped in the swabbing solution and spread as a barrier in front of the invading larval swarm, make an efficient and cheap bait.

The Paris green-bran cutworm bait formula is as follows:—Paris green, 1 lb.; molasses, 2 quarts; bran, 25 lb.; water, 2 to 2½ gallons. The Paris green and bran are thoroughly mixed dry, and the water in which the molasses has been dissolved is added to the mixture to make a friable crumbly mash. This bait is either scattered in front of the caterpillars and around the plants or distributed along the bottom of ploughed furrows separating the crop from the migrating pests.

Where the plants are very small, the use of baits is preferable to the swabbing method, for young plants treated with the swabbing fluid are often badly injured before the larvæ obtain a lethal dose of the poison. However, once the plants are established, swabbing with the sweetened poisoned solution is the most effective way of destroying the pests.

The cutworm bait scattered under and around the plants is a very successful method for combating cutworms and grasshoppers when they become established in a field. It is also effective in reducing the field population of adult beetles of the false wireworm.

Care must be exercised in the use of the swabbing mixture and the cutworm bait, for both contain a very poisonous chemical.

SCUMMY CREAM.

It frequently happens that when cream is being put through the strainer into the vat at a factory, a quantity of thick greasy substance is retained by the strainer. In most cases this is due to the inclusion of the thick scum from the interior of the separator bowl with the cream. This is a practice which cannot be condemned too severely and results frequently in the cream being graded down.

The Squirter Disease in Bananas with Special Reference to Its Control.

J. H. SIMMONDS, M.Sc., Senior Plant Pathologist, Department of Agriculture and Stock, and R. S. MITCHELL, M.Sc. Agr., Junior Research Officer, Council for Scientific and Industrial Research.

THE squirter disease of bananas, whilst well known to southern merchants and retailers, is merely a name to most banana-growers since it makes its appearance only as the fruit ripens and is rarely seen on the plantation. Nevertheless it is recognised as being one of the most serious, if not the most serious, transport disease affecting Australian bananas.

The symptoms consist of a dark watery rot which appears first along the centre of the pulp of the fruit—whence it extends outwards. In the early stages of infection it is usually impossible to recognise the disease on external examination. In more advanced stages the fruit is soft under pressure, this softness being towards the stalk end, but, until the flesh becomes semi-liquid so that it squirts out when pressed the disease can only be diagnosed by an examination of the interior. The affected fruit may be represented by a few scattered individuals in the case or may be as many as twenty-five to thirty per cent. and occasionally even more.

The difficulty in detecting the presence of squirter by a superficial examination of the case results in a very important indirect loss due to the prejudice formed against certain brands. Buyers tend to "hold off" consignments which, by experience, are known to have come from a grower who has previously forwarded affected fruit. There is also, naturally, a decreased demand by the consumer during periods when squirter affected fruit is in evidence.

Squirter is of importance only during the winter and early summer, mainly in the months from April to November, inclusive. Isolated cases have been recorded during December, January and March.

The Development of Ideas Regarding the Cause of Squirter.

The investigation of the cause and control of squirter has had a somewhat chequered history. A trouble referred to under this name was known as far back as 1920. An enquiry into the cause of the disease was first undertaken by Goddard [1] who came to the conclusion after several years' work that cool temperatures in the winter produced a physiological state of the fruit which responded to unsuitable temperature or other conditions during transport with an ensuing development of squirter. Young, Bagster, Hicks, and Huelin[10], in a report on the ripening and transport of the Cavindish banana, recorded some interesting experiments in which they showed that bananas held for several days at a temperature of 53 deg. Fahr. or lower developed a much higher percentage of squirter than those not subjected to chilling. These authors considered that exposure to low temperatures during storage or transport might accentuate the trouble which appeared to be, at least in part, due to some predisposing condition developed on the plantation. King[6], who carried out a soil survey in connection with the

For a more detailed account of squirter the reader is referred to McLennan and Hoette[8], Magee[7], and Simmonds[9].

incidence of squirter, came to the conclusion that soil type had no effect on the development of the disease. He noted the association of squirter losses with cold situations and suggested that a cold period might cause a cessation of certain physiological processes rendering the fruit more subject to breakdown.

The first suggestion that squirter might be of parastic origin came from Dr. D. A. Herbert[2] who in 1931 noted the presence of a fungus in affected fruit and later isolated this and determined it to be a species of *Nigrospora*. In 1933 McLennan and Hoette[8] in Melbourne and Simmonds[9] in Brisbane published the results of independent investigations which proved conclusively that the squirter rot was the result of infection by a parasitic fungus. The causal organism was referred to a new species of *Nigrospora, N. musae,* by the former authors and to *N. sphaerica* by the latter. Hoette[4] demonstrated later that the same organism was also responsible for a considerable proportion of the black end occurring during the winter and spring months.

As a result of this work it was shown that the internal nature of the rot is due to the manner of infection. The organism enters one or more vascular strands at the broken stalk end and travels down these without lateral extension until the ovular region is reached. The *Nigrospora* was found to be present in the plantation on dead banana tissue such as leaves, petioles, and bracts, and also on banana debris in and around the packing shed. The fungus has also been recorded on several of the common grasses found in the vicinity of the plantation as well as on sugar cane, rice, and maize. In the case of the last mentioned the organism exists in a pathogenic capacity, causing a dry rot of the ear.

Several aspects of the squirter problem were still in a doubtful position after the publication of the two papers mentioned. There was, firstly, the question of the correct nomenclature of the causal organism. Although this is a somewhat academic point it does have a practical bearing in that it is necessary to distinguish between parasitic and non-parasitic forms of *Nigrospora* when investigating all sources of spore contamination. Secondly, the contributing effect of chilling, although a recognised fact, could not be adequately explained. Lastly, and most important of all, the practical control of the disease was not in a much better position after than before the cause was known. The obvious suggestions regarding sanitation, although no doubt helpful, did not result in a definite control of the disease.

During the latter part of 1934 and the years 1935 and 1936 the junior author was seconded by the Council for Scientific and Industrial Research to the Department of Agriculture and Stock, Queensland, to assist in the investigation of banana transport diseases. This was made possible by the Commonwealth grant towards the development of scientific research in the banana industry. Although most attention was paid to black end and anthracnose, some work having an important bearing on the control of squirter was also carried out and it is chiefly with this that the present paper seeks to deal.

Following on the work reported in the paper already cited, Hoette[5] carried out some further investigations in Queensland and New South Wales. These were, by arrangement, mainly of a mycological and physiological nature and have been summarised in an unpublished report

to the Council for Scientific and Industrial Research to which the authors have kindly been give access. Reference is made to this report in connection with matters of relevant interest.

Early Investigations Bearing on Control.

As long as squirter was considered to be of physiological origin it was difficult to arrive at a fully effective means for controlling the disease. Certain practical suggestions were based on the knowledge that cold temperatures were a contributing factor. These received support from the work of Young, Bagster, Hicks, and Huelin[10], who showed that chilling on the plantation or during transport was detrimental to the proper ripening of the banana and was definitely conducive to squirter development. The chance of fruit being subjected to excessively cold temperatures while in transport although not great is now minimised during the winter months by sheeting the railway trucks and insulating the fruit in the case by packing with a complete lining of paper. Hicks and Holmes[3] showed that the risk of chilling in the plantation is more serious and it is a recommendation that, during cold weather, the fruit should be picked during the warmer part of the day and should be covered and protected from the cold as much as possible until placed in the van.

Young[10] and his co-workers quote an experiment in which it was shown that considerably less squirter developed in fruit packed in hands and part hands than in singles, facts which are easily explained now that the parasitic origin of the disease is known. These results were later confirmed by Hoette[5] and the authors. It was shown by the former who used artificially inoculated fruit that the greatest reduction is obtained when the fruit are packed in full hands with an appreciable amount of cushion left attached. The amount of squirter developing in a part hand pack is usually definitely less than in the case of singles, but is of a somewhat variable order. Packing in hands and part hands avoids a certain amount of injury through bending and splitting of the stalk, which may not be entirely eliminated even when the utmost care is exercised when breaking into singles. This method therefore also has the advantage that there is less loss from the development of black end. The full hand pack has a number of disadvantages from the commercial point of view. The part hand pack is preferable as it has these drawbacks to a considerably less extent. However, the adoption of the part hand pack, while bringing about an appreciable reduction in losses, is not a sufficiently reliable or efficient method of control to be regarded as a satisfactory solution of the squirter problem.

With the knowledge that squirter was caused by infection by the spores of a parasitic fungus, it was natural to suggest sanitation measures. It has been shown by Simmonds[9] and later confirmed by Hoette[5] that the source of infection lies in the *Nigrospora* associated with banana trash, old fruit stalks and other debris in and around the packing shed and even more particularly with dead leaf stalks, dead areas of leaf tissue, and the bunch bracts and spathe in the plantation. The exposure of plates of culture media in the packing shed and plantation has shown that the spores are commonly wind borne.

Although fresh infection is possible in the packing shed, examination of fruit before harvesting and immediately on arrival at the shed shows that they are, in many cases, already plentifully scattered with

Nigrospora spores, and it is accordingly considered that the plantation is the most important source of contamination. During the operation of breaking into singles and packing the organism is enabled to reach the freshly exposed surface of the fruit stalk and bring about infection. Cleanliness in the packing shed, coupled with periodic spraying thereof with 5 per cent. formalin solution, will tend to reduce the amount of infection taking place at the shed, but will not account for those spores which are present on the fruit when it arrives there. The authors conducted an experiment to see whether the careful removal of all dead leaf material and bracts from a block of plants, in conjunction with spraying the packing shed with formalin, would reduce squirter losses. No essential difference was noted in the distribution of squirter in fruit from this and the control block. Possibly had the treatment been carried out over the entire plantation for a longer period at frequent intervals instead of only the once, better results might have been forthcoming.

Control by a Fungicidal Treatment of the Fruit.

It is obvious that all the measures so far described, although contributing to a reduction in the amount of squirter developing, can not be relied upon to eliminate it entirely and even a small percentage of affected fruit is sufficient to prejudice southern buyers. To attain the desired end, it appeared necessary to develop a method of sterilizing the surface of the fruit immediately prior to packing. As pointed out by Simmonds[9] a treatment at this time is not impracticable provided a suitable fungicide is available. Both Hoette[5] and the authors showed that dilute solutions of formalin as well as certain other fungicides would prevent the germination of *Nigrospora* spores and carried out preliminary field tests which were, however, inconclusive. Attention later became focussed on developing a fungicide for the control of black end and anthracnose and as these diseases were easier to work with than squirter the control of the latter was left in abeyance for the time, it being considered that a treatment effective for *Gloeosporium musarum* would be equally so for *Nigrospora*.

For the control of black end and anthracnose vapour and liquid treatments were tried. Formaldehyde gas, sulphur dioxide and several other vapours were used, but these either failed to give control or when used at an effective concentration resulted in severe injury to the fruit. Wet treatments included formalin at various strengths, Shirlan, malachite green, sodium benzoate, copper sulphate, and borax. In most cases laboratory experiments with inoculated fruit and field tests were carried out. A solution of formalin at ·25 per cent. and 1 per cent. strength used as a dip reduced the amount of black end somewhat and caused only slight injury to the fruit. Shirlan A.G. and XP18 at ·75 per cent. concentration and over gave somewhat better control, and caused no injury. No appreciable deposit was left at concentrations of less than 3 per cent. Borax used at 4 per cent and 8 per cent. in water at 50 deg. and 54 deg C. gave good control of anthracnose and a control of black end similar to that of formalin, but the necessity for maintaining a constant temperature and other disadvantages make the use of this material uneconomic. It was very noticeable that the control exerted by Shirlan when a large proportion of the black end was due to *Nigrospora* infection was much greater than when *G. musarum* was the chief causal agent. This is illustrated in Table I.

TABLE I.

THE DIFFERENCE IN THE EFFECT OF SHIRLAN ON BLACK END WHEN DUE TO INFECTION BY (1) *Nigrospora* AND (2) *Gloeosporium musarum.*

Treatment.	Organism mainly responsible.	Percentage of severe Black End.	Number of fruit.
Dipped 1·0 per cent. Shirlan A.G. ..	*Nigrospora*	0·3	398
Untreated	..	48·6	372
Dipped 1·5 per cent. Shirlan A.G. ..	*Gloeosporium* ..	3·3	155
Untreated	..	9·8	165
Dipped 3·0 per cent. Shirlan A.G. ..	*Nigrospora* ..	8·2	447
Untreated	..	61·9	540
Dipped 3·0 per cent. Shirlan A.G. ..	*Gloeosporium* ..	4·1	171
Untreated	..	14·3	134

Since none of the fungicides used could be claimed as an unqualified success so far as black end and anthracnose were concerned it became necessary to take up the matter with special reference to squirter. Some difficulty was experienced in obtaining satisfactory and uniform infection with the disease. In the latter part of 1936, however, a plantation from which it was possible to obtain heavy natural infection with squirter came under notice and results of a conclusive nature were obtained from field experiments carried out there. As Shirlan had given best results in the control of black end this fungicide was used at first and the success was so marked that all future work was concentrated on how the Shirlan could be put to best advantage. Formalin was known to inhibit germination of the spores and Hoette[5] had obtained an indication that it might be useful as a fruit treatment, but the disadvantages in that there is danger of serious skin injury with solutions stronger than 1 per cent. and that reinfection is possible once the solution has evaporated are such that this disinfectant was not further investigated.

Fruit for the field experiments was obtained at the plantation in the bunch, brought to the packing shed and there cut and treated immediately. Comparable lots of fruit were obtained by dividing each hand into two or three approximately equal parts, depending on the number of lots required. The fruit were broken into part hands or singles as the case might be, immersed in the suspension of Shirlan for just sufficiently long to ensure thorough wetting, and then drained and packed. They were ripened as slowly as possible in the rooms of the Committee of Direction of Fruit Marketing by subjecting them to the lowest temperature available at the time.

In the original experiments, when Shirlan XP18 was used, only the fruit which felt soft at or near the end was examined internally. In subsequent trials all the fruits were cut longitudinally to ensure that no affected ones were overlooked. Throughout these experiments all doubtful and some definite infections were tested by making tissue plantings from the flesh to potato dextrose agar. Particular attention in this respect was given to treated fruit. The small number of doubtful cases which gave growth to *Nigrospora* were classified accordingly.

In Table II. are given the results obtained by the use of three forms of Shirlan at different strengths. All the experiments listed were field trials, and in each case the fruit was broken into singles for packing. Shirlan A.G. is the commercial article on the market in Queensland. It consists of a 25 per cent. suspension of salicylanilide in

water together with a wetting and spreading agent. Shirlan W.S. is the water soluble sodium salt of salicylanilide while Shirlan XP18 has copper in combination. Neither of these two appeared to possess any advantage over Shirlan A.G.

TABLE II.

THE RESULTS OF TREATING BANANA FRUIT WITH SHIRLAN FOR SQUIRTER CONTROL.

Fungicide.	Method of Dipping.	Per Cent. Squirter.		No. of Fruit.	
		Treated.	Untreated.	Treated.	Untreated.
Shirlan XP18 3 per cent.	Singles	0	1·0	88	199
Ditto	Hands	0		95	
Ditto	Singles	0	1·1	186	190
Ditto	Singles	0	5·6	136	142
Shirlan XP18 1 per cent.	Singles	0	12·2	79	80
Shirlan W.S. = 1 per cent. A.G.	Singles	0		82	
Shirlan A.G. 6 per cent.	Singles	0	11·1	221	216
Shirlan A.G. 3 per cent.	Singles (ends only) ..	0		134	
Ditto	Singles	0		127	
Ditto	One-third hands ..	1·6	30·2	337	356
Ditto	Singles	0		339	
Shirlan A.G. 1 per cent.	Hands with bunch stalk attached	17·5	17·1	145	192
Ditto	Singles	0		187	
Ditto	One-third hands dipped and dried	0·6	21·7	153	180
Ditto	Singles	0		211	

All fruit represented in this table were packed in singles.

The results show complete control of squirter with all strengths of Shirlan used, when the fruit were dipped in singles. Dipping in one-third hands and then breaking into singles gave a reduction from 21·7 per cent. and 30·2 per cent. in untreated fruit, to 0·6 and 1·6 per cent. for a 1 per cent. and 3 per cent. suspension respectively. This is good commercial control, and it is furthermore considered that, if the fruit were to be dipped in part hands and then packed as such, without further exposure of broken surfaces, the control would approximate to that obtained by dipping in singles. Treatment with the bunch stalk still attached is unsatisfactory. The comparative results obtained for dipping before dehanding, dipping part hands, and dipping the fruit in singles suggest that a protective covering over the cut and broken end is essential for complete control by Shirlan.

A certain amount of blackening and drying of the fruit stalk occurred but, even with 3 per cent. Shirlan, this is not sufficient to be of commercial importance. With concentrations of 3 per cent. and

higher a grey powdery residue is left on the fruit. With 1 per cent. this deposit occurs in occasional isolated areas and can be detected only after careful examination.

As a result of these experiments it is firmly considered that a practical and economic method of controlling squirter is now available. Immersion of the fruit as singles (or part hands when packed as such) in a 1 per cent. suspension of Shirlan A.G. is recommended as a routine practice during the winter and early summer months on all plantations where experience suggests losses from squirter are likely to occur. It is worthy of note that this treatment also reduces black end, particularly black end due to *Nigrospora.* Hands should be broken into singles and dipped in the Shirlan mixture as soon as possible after they are removed from the bunch. When a convenient number of fruit have been immersed they can be removed and drained for a few minutes when they are ready for packing.

According to the manufacturers the diluted Shirlan will keep for a considerable period without deterioration. Hence it should be possible to use the same mixture on more than one packing day provided a method of preventing evaporation is available.

Previous recommendations such as the prevention of chilling, sanitation in the plantation and packing shed, and others, still hold good and should be used in conjunction with the dipping. In many cases, where squirter infection is rare, these precautions will be all that is required and the treatment with a fungicide will be unnecessary.

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Contagious Pneumonia in Pigs.

PNEUMONIA is one of the commonest diseases of pigs in this State and is responsible for considerable losses each year. It appears in several forms, having a variety of causes, and may be deal twith as follows:—

1. Pneumonia caused chiefly by a specific germ (*Bacillus suisepticus*).
2. Peumonia caused by pyogenic bacteria (chiefly *Bacillus pyogenes suis*).
3. Parasitic pneumonia caused by infestation of the large round worm of pigs, *Ascaris lumbricoides*.

All forms are most commonly encountered in young pigs in that stage of life between weaning and bacon or porker age.

The varied symptoms, post-mortem appearances, and mortality rate make it possible to differentiate the types with little difficulty.

Swine Plague.

This, caused by *B. suisepticus,* is probably responsible for the majority of outbreaks of pneumonia in young pigs.

Undoubtedly this form of contagious pneumonia has been present in this State for a considerable time, and it would appear to have a wide spread distribution.

The disease may suddenly appear in a herd of pigs without any history of introduction of new pigs or contact with suspected cases.

Infection.

The causal organism may be present in the respiratory tract and alimentary canal of normal pigs, also in the soil, food, and drinking water, so it is obvious that factors other than the mere presence of the organism are necessary for the production of the disease. Thus it is believed that organisms present in the normal animal and ordinarily causing no harm, are spurred to an added virulence by certain conditions of diet and/or general surroundings which also tend to lower the natural resistance of a susceptible animal, with the result that the organism, with its greater disease producing capacity, overcomes the weakened resistance of the animal and the symptoms of swine plague appear.

Keeping in mind the manner in which the disease is produced, it is easy to appreciate the fact that swine plague is more likely to be encountered in piggeries where general management and feeding are far from ideal.

However, swine plague often occurs in piggeries where conditions are excellent, and in such cases it is not infrequently found that the factor responsible for the increased virulence of the organism is dietetic in nature—some sudden change in the routine of feeding or quality of the food.

It must not be overlooked that affected pigs are a danger to others, and when a pig has apparently recovered from the disease it not uncommonly still acts as a "carrier" on account of the continued existence of a small patch of pneumonia in the lung. The contact of young and grown pigs should therefore be avoided.

Symptoms.

These may be per-acute, acute, and chronic in type.

In the per-acute form the pig will suddenly be noticed to be sick, with a high temperature, lying down and having no inclination to move, any such attempt being marked by a staggering involuntary gait. The affected pig may sit on its haunches with head stretched out, breathing being rapid an distressed. Usually death quickly supervenes, occurring 12 to 24 hours after the onset of symptoms, or may sometimes occur without warning symptoms, the animals simply being found dead.

The symptoms of the acute form are those of an active pneumonia, i.e., there is high temperature, little inclination to feed, coughing is marked, and the breathing rapid, panting, and distressed, giving rise to a common name for the disease—"pants"; a sticky discharge from the nostrils, and sometimes from the eyes is common.

Constipation, present in the early stages, is often followed by a blood-flecked diarrhœa, particularly towards the end of the sickness, which lasts 1 to 2 weeks and usually terminates in death.

The chronic form may follow a partial recovery from either of the above forms, or may appear in the herd as the typical form. The general appearance of the animals is altered, pigs becoming sluggish in movement, and the appetite is partially lost, maybe perverted, affected pigs eating all types of foreign material. Coughing is persistent, breathing somewhat laboured, and badly affected animals will assume a position with backs arched and front legs spread wide apart. Sticky discharges are usually present from nostrils and eyes, and a constipated state commonly followed by diarrhœa. Skin eruptions may also be present in the form of red spots, scabs and scales later forming over them. Inflammatory swellings may occur in the joints, leading to stiffness and lameness. The disease runs a course of two to three weeks. Some animals gradually recover, the lameness disappearing, scales peeling off and leaving a healthy skin and the discharges clearing up, but a short, sharp cough usually persists.

It must be realised that the above description of symptoms of per-acute, acute, and chronic forms of Swine Plague refers to typical forms; actually an outbreak of Swine Plague may present all three types, or some combination of these types.

Post Mortem Appearances.

Naturally these vary according to the form the disease has taken.

In the per-acute form the post-mortem changes are not particularly obvious, but on examination the lymphatic glands are found to be swollen and usually darkish-red in colour, and a gelatinous fluid may be pressed from the tissues in the region of the neck and from the swollen (œdematous) lungs.

The commoner acute form shows more typical changes, particularly in the chest cavity, where the lungs are found to be affected with a definite pneumonia, the colour of the lungs varying from dark-reddish to light-grey, and the substance of the affected lung is firmer than a normal lung. An extensively affected lung will not float in water. An excessive amount of fluid may be found in the chest cavity and in the sac surrounding the heart, and affected areas of the lungs will be seen to adhere to the chest wall by fibrous strands and patches.

Lymphatic glands of the chest may be swollen and slightly hæmorrhagic, while the mucous membrane of the stomach and intestines often shows inflammatory changes varying from slight congestion to more intense congestion with occasional hæmorrhagic areas.

The changes observed on post-mortem examination of animals, dead from the chronic form, are mainly confined to the lungs, which, without showing intense changes seen in the acute form, possess areas of somewhat solid consistency, light-greyish-red in colour and smoother in appearance than normal lung. Lung adhesions are marked, the walls of the chest cavity presenting a discoloured roughened and stringy appearance. Reddish-yellow fluid may be noticed in the chest cavity and in the sac surrounding the heart. General lesions of emaciation are present in cases of considerable duration.

Treatment and Control.

Medical treatment is not recommended, greater importance being attached to prevention and control. Preventive vaccination may be carried out, but should never be considered without complete discussion and investigation by the Veterinary Officer.

The practices of inbreeding and intensive feeding are often responsible for the conditions of lowered resistance and greater virulence previously referred to, and such proceedings should therefore be carefully controlled.

Particular care should be paid to the hygienic conditions of the piggery as regards housing and general accommodation. Factors such as exposure to cold, overcrowding in small runs, and unsuitable sheds, and the entire question of feeding, must be investigated. Where a piggery suffers an outbreak of Swine Plague and the owner is quite sure that the best possible conditions of general accommodation prevail, it would be wise to thoroughly check over the question of feeding.

Immediate isolation of all infected pigs is of paramount importance.

In those cases where no improvement is noticed after a couple of days, the wisest procedure is to slaughter affected animals. Even should an infected animal subsequently recover there is the possibility of relapse with reinfection of the piggery.

Steps should be taken to exclude poultry from the piggery, because in the presence of poultry complete isolation of infected pigs is impossible. Certainly where poultry have access to contaminated troughs and yards they are going to spread infection to every yard which they may happen to stain with their droppings.

Thorough disinfection of infected premises with lime is necessary, and where the infection is widespread throughout the piggery it is advisable to consider the establishment of a fresh site.

Pyogenic Pneumonia.

While Swine Plague is probably the commonest type of pneumonia encountered, other forms exist. The chief one of bacterial origin is that caused by *B. pyogenes suis,* the symptoms of which are as follows:—

The first sign of anything wrong may be the onset of nervous symptoms, the commonest being the holding of the head on one side, movement being in circles. The nervous symptoms wholly or partially subside and an acute pneumonia develops, the affected pig being loth to move about, the appetite diminished or absent, and the breathing distressed and very rapid.

The symptoms become progressively worse, the affected pig remains prostrate and death usually supervenes about seven to ten days after the onset of symptoms.

Abscess formation may occasionally be noticed in the region of the hock and knee joints.

Post-mortem appearances are rather typical and small areas of yellowish pus being found in various parts of the body. Muscles, subcutaneous tissues, and lungs contain these purulent foci, which may also be present in lymphatic glands, joints, kidneys, spleen, liver, and bones.

Medicinal treatment is of no use, and if the disease is to be controlled the measures recommended for the control of Swine Plague should be adopted.

Parasitic Pneumonia.

This form of pneumonia is caused by migration through the lungs of immature forms of the large round worm of pigs. It is fairly common in young pigs, but usually does not run the severe course described for the bacterial forms.

Persistent coughing and sluggish development are the commonest manifestations of the condition.

It is found that in the two bacterial forms of pneumonia the number of pigs affected on a property is not excessive, but the majority of affected pigs die. Parasitic pneumonia on the other hand affects a large number of young pigs on a property but deaths are few.

In the event of any piggery becoming affected with sickness resembling the diseases described above, the owner would be well advised to isolate affected animals immediately and communicate with the district Veterinary Officer to establish diagnosis and arrange subsequent methods of control.

PARSNIP GROWING.

Although the parsnip is a native of England and must therefore be classed as a temperate climate vegetable, it may be grown with reasonable success in the tropics during the winter season.

Soil for growing this vegetable should be deep, rich, and free. A good sandy loam gives excellent results. The soil should be prepared some months previously by trenching or cultivating deeply, and incorporating a heavy dressing of stable manure. Organic manures should never be applied in considerable quantities immediately before planting this crop, as they frequently induce forking of the roots. At the end of the wet season the ground should be thoroughly worked up and reduced to a very fine tilth. The seed is then sown thinly and very lightly raked over, after which the soil should be rolled or well packed down with the back of a spade along the drills. The packing is necessary to ensure close contact between the seeds and the soil. A light covering of old horse manure well crumbled, or old sawdust, will assist germination by preventing the caking of the soil.

As soon as the seedlings are well up, thin them out where they are overcrowded and, when about 4 to 6 inches high, thin out finally to about 1 foot apart.

Parsnip seed is usually of rather poor germinating capacity, and is practically useless unless quite fresh.

—*S. E. Stephens.*

Hints for Pig Exhibitors.

E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

THE desire of every stud stock breeder is to develop animals that will win awards in the best of company. The following points are suggested for the consideration of show exhibitors:—

Selection.

The possibility of securing premier honours, while depending very largely on bodily conformation, colour markings and freedom from faults, depends also on the time the exhibitor is willing to give to the preparation of his stock and the businesslike attitude he adopts towards the job. He will learn by experience that there are times when a few extra minutes spent, and additional care, may mean the difference between a champion, a first, a second, or even a third prize. Successful exhibitors spare no effort to do everything possible to have their stock ready at the time of judging.

Some animals are more readily handled than others, some are good feeders, some are intelligent, while others are good but stubborn. Some feed well in familiar surroundings, but when placed in the show pens in a strange environment become restless and disgruntled, refuse to eat, and rapidly lose bloom, thus spoiling the exhibitor's chance in competition.

In selection, nothing but the best should be penned. It is useless filling up show pens with second-grade animals. The size and importance of the show, and the competition, must of course be taken into consideration. To win a championship at a small country show is quite different from winning premier awards at a show like the Royal National, Brisbane, or the Royals at Sydney and Melbourne.

The exhibitor should study carefully the prize schedule long before the show at which he proposes to exhibit, and should aim at having his animals entered in classes for which they are most suited. A class for boar over nine months and under twelve months is more readily won, other things being equal, with a boar twelve months' old than with one at nine months old. The prize for sows with litter not more than ten weeks of age is more frequently won with a really good sow with a litter ten weeks of age, than with a really good sow and a litter ten days old.

Size for age is also important. In a class for sow twelve months of age the sow should be fairly forward in her gestation period; a sow not in pig does not or should not stand the same chance of winning.

Plate 180.

Typical Large White Sow showing long sides and back, deep roomy body, well-developed udders and teats, and other desirable feminine characteristics.

Animals with manifest faults should never be exhibited. A boar with only one testicle showing, or a sow with several blind or dummy teats, should be rigorously excluded. A pig with a long, unmanageable tongue, which protrudes several inches from the mouth, should not be shown, nor should pigs that are mismarked or otherwise faulty.

Condition.

Breeding stock should be shown in good breeding condition only: any tendency to excessive fatness should be avoided. If breeding stock over twelve months of age are any good as breeders, and are shown in profitable condition, they will not be overfat. Similarly, animals in low condition are undesirable: even a sow with a large litter should be in good condition, otherwise she will not show to advantage.

Commercial stock should be shown in medium condition only, for there is no demand for very fat meat, and the judge is at fault who recognises and places overfat animals.

All pigs shown should be absolutely free from parasites—body lice, fleas, or worms. Animals with a vicious temperament should be excluded, and should not be kept on the farm.

Preparation.

It is unwise to smear the skin and hair with a heavy coat of sticky oil. It is equally unwise to permit the exhibition of pigs without first thoroughly washing and cleansing the skin and hair. Regular washing with warm water and soft soap should be the rule for several weeks before the date of showing. The exhibitor who pens pigs bespattered with mud and in a dirty condition, only exposes himself to criticism. Careful washing and grooming, and a light brushing over with a brush or cloth, using colourless oil, is advised, and especially immediately before parading. Regular oiling will assist in keeping the animals free of parasites, and in mellowing the skin and hair, with obvious advantages.

Plate 181.

Typical Berkshire Boar, a prominent prize winner at Queensland shows. Note great depth of body, strong masculine characteristics, and correct colour markings.

In the exhibition of stud pigs, clipping of the hair is always objected to as it is not actually necessary, and any attempt to clip with a view to removing natural markings is an offence.

Animals should be carefully trained to parade properly, and to stand at ease before the judge. The anxious, excitable animal—who also is in charge of an excitable exhibitor—usually fares badly, whereas the well-trained animal in the hands of a patient, observant exhibitor, is more likely to succeed.

Judging Rings.

It is, of course, essential to parade all mature animals before the judge, for it is quite impossible to judge mature stock satisfactorily while they are penned in small enclosures. Judging rings are best where they can be arranged for, provided that the animals are well-trained, and that exhibitors are prepared to devote time to the job.

Feeding.

Regular exercise is essential to the successful exhibition of pigs, and plenty of green food, and clean drinking water should be provided. Purgative methods should not be employed, nor should foods of a very laxative nature be used.

The animal should not be overfed, nor should stale, sour, or high-smelling food be used. The food troughs should be scrupulously clean. Feed should be given strictly at regular intervals, and, most important of all, the same class of feeding stuff should be used for several days before taking the pig to the show, so that it may become accustomed to any change of food. If an animal refuses to eat, and appears to be losing bloom, a slice or two of apple or carrot, a piece of pumpkin, or some such tasty morsel—especially if sprinkled with salt—will often bring the animal back to its food. In fact a very light sprinkling of salt over the food followed by clean drinking water will be found useful for show pigs. Clean, dry straw, and plenty of it, is advisable for bedding down, and will make the animal feel more at ease. Sawdust, shavings, corn husks, or leaves are not advised if it is possible to substitute straw. The pens must be kept clean, and soiled bedding and dung must be removed regularly every two or three hours.

General.

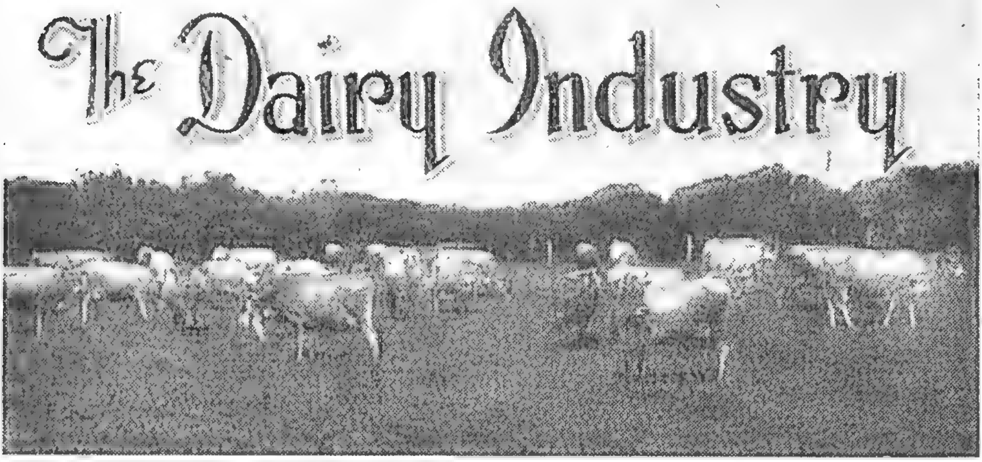
It is unnecessary for the exhibitor to appear before the judge in "pig pen togs"; he should be just as spic and span as the animal. A combination of both, added to a pleasant, courteous manner, and a smile even under difficult circumstances, does much to create confidence. The exhibitor should watch the animal during judging; but should not watch the judge, except to receive instructions. When the judge has finished with an animal, its owner should not worry other exhibitors, who are just as keenly interested in their own exhibits, as he is in his. The judge has a difficult task, and he appreciates the co-operation of exhibitors in placing the animals before him. Exhibitors should not try to influence the judge; but should be ready at any time to answer any questions the steward might ask. When judging is completed, the exhibitor should await a favourable opportunity for having a chat to the judge about the exhibits. Shows are educational, and are for the purpose of providing comparisons. Exhibitors are, of course, entitled to their own opinions just as much as the judge.

Agricultural societies are always glad to have suggestions from exhibitors. Every exhibitor is, or should be, a show official, and as such should have some influence on the success or otherwise of the show. Exhibitors have the privilege of sending in nomination of judges for consideration by the show society.

It is well to remember that it is only fair to other exhibitors of pure bred stock that the stud pigs of others should be registered in the appropriate herd book, or be eligible for registration. The Australian Stud Pig Breeders' Society provides for registration. It is wise also to have printed pedigree forms for stud pigs, and it is important to have the pedigrees prepared in readiness, so that when an animal is sold, the pedigree may be handed over with the receipt. Delay in the issuing and forwarding of pedigrees, and the incorrect preparation of pedigrees which are lacking in detail, cause trouble, confusion, and unnecessary inconvenience to the buyer.

Judicious advertising should not be neglected. The Stud Pig Breeders' Society will advise any breeder interested as to the prices he or she should ask for pedigree male or female animals.

Full particulars about the size of crates, material to be used, method of construction, and other relevant information, may be obtained free of cost from the Department of Agriculture and Stock. Crates should be returned promptly if required and in as good a condition as when received.



Estimation of Acidity in Milk, Cream and Whey.

L. A. BURGESS, A.A.C.I., Dairy Research Laboratory.

THE regulations under the Dairy Produce Acts specify that no milk containing more than 0·25 per cent., nor cream containing more than 0·67 per cent. of acidity shall be classified as first-grade quality. The development of acidity in milk and whey is all important in cheesemaking and accurate control of cream acidity plays a very large part in the manufacture of a good quality butter.

For these reasons it is essential that accurate acidity tests be performed at all times. Attention to details and a knowledge of the principles involved in the estimation are as necessary to the factory operative as they are to the analyst.

Reagents.

1. *Decinormal sodium hydroxide,* also known as tenth normal or N/10 alkali.

2. *Phenolphthalein* indicator solution.

Apparatus.

1. *Burette,* graduated in 0.1 ml. divisions.

2. *Burette stand* and *clamp,*

3. *Pipette,* may be of any desired capacity. Usually a 9 ml., 10 ml., 17·6 ml., or 20 ml. pipette is used.

4. *Titration vessel.*

5. *Glass stirring rod.*

Determination.

(a) *Milk and Whey.*—By means of the pipette measure out a known volume of milk or whey, wiping the outside of the pipette *before* adjusting the bottom of the meniscus to the graduation mark.

Transfer to the titration vessel. Add 5 to 10 drops of phenolphthalein solution. From the burette run in the decinormal sodium

hydroxide solution drop by drop stirring the contents of the vessel constantly. Stop when the first tinge of pink colour appears. Read off the volume of decinormal alkali solution used.

$$\text{Percentage of acidity} = \frac{\text{ml. of N/10 alkali used} \times 0{\cdot}009 \times 100}{\text{quantity of sample taken.}}$$

(b) *Cream.*—By means of the pipette measure a known volume of cream, wiping the outside of the pipette *before* adjusting the bottom of the meniscus to the graduation mark.

Transfer to the titration vessel. Rinse out the pipette with warm distilled or rain water by filling to approximately the position of the graduation mark and add the rinsings to the contents of the titration vessel. Add five to ten drops of phenolphthalein solution and proceed as directed for milk and whey.

Acidity.

When milk is freshly drawn from the udder it has an acidity ranging from 0·1 to 0·2 per cent., in some cases even higher, the average being about 0·17 per cent.

This initial acidity is due to acid salts, casein, and dissolved carbon dioxide. On exposure to the air some of the carbon dioxide escapes and the acidity drops a little. It soon begins to rise again owing to the action of bacteria which act upon the lactose, forming lactic acid. There are thus two forms of acidity in milk, the initial acidity due to normal milk constituents and that due to lactic acid.

As it is difficult to differentiate between the lactic acid and other acidity, the whole acidity is for convenience calculated and reported as percentage of lactic acid.

Principle of the Test.

When an acid is mixed with an alkali a chemical reaction occurs with the formation of a neutral substance, termed a salt, and water. This reaction is known as neutralization. Thus when lactic acid and sodium hydroxide react, neutralization occurs with the formation of sodium lactate and water.

$$\underset{\text{Lactic acid}}{C_3\,H_6\,O_3} + \underset{\text{Sodium hydroxide}}{Na\,OH} \longrightarrow \underset{\text{Sodium lactate}}{C_3\,H_5\,O_3\,Na} + \underset{\text{Water}}{H_2O.}$$

As this is a reaction between definite chemical compounds, it is a comparatively simple matter to estimate the percentage of lactic acid when a known amount of milk or cream is initially taken and neutralized with a sodium hydroxide solution of known strength. The neutralization must not be overdone, however, and a substance known as an indicator is used to show when the neutralization is complete. Indicators are substances which display a marked colour change in acid and alkaline solutions. Phenolphthalein, for example, is colourless when acid and red when alkaline, and has been found to be the most suitable indicator for the particular purpose under discussion.

Calculation of Percentage.

From the equation shown above it has been calculated that ninety parts by weight of lactic acid will be neutralized by forty parts by weight of sodium hydroxide. The decinormal sodium hydroxide is made to a

definite strength and contains 4 grams per litre. Thus 1 ml. (one thousandth of a litre) contains 0·004 gram of sodium hydroxide. It is just a matter of simple proportion to determine that 1 ml. of decinormal sodium hydroxide solution will neutralize 0·009 gram of lactic acid.

When a known quantity of milk or cream is taken and the acidity is neutralized by a determined volume of decinormal sodium hydroxide, the percentage of acidity may thus be determined:—

$$\text{Acidity percentage} = \frac{\text{ml. of N/10 alkali used} \times 0{\cdot}009 \times 100}{\text{quantity of milk or cream used}}$$

This equation may be used when any known quantity of milk or cream is taken. Applying it to the widely used 9 ml. pipette the equation becomes

$${}^{*}\text{Acidity percentage} = \frac{\text{ml. of N/10 alkali used} \times 0{\cdot}009 \times 100}{9}$$

$$= \frac{\text{ml. of N/10 alkali used}}{10}$$

* Strictly speaking this only gives the percentage by volume, i.e., 100 volumes of milk or cream contain so many parts by weight of lactic acid. The figure so obtained is, however, close enough for most practical purposes.

When any other volume of milk or cream is taken the full equation must be used.

Precautions to be Observed.

1. *The sample taken for examination must be representative of the bulk.*—This is so obvious that a detailed discussion is unnecessary. Care must therefore be taken to thoroughly mix the contents of the vat or other container, then take a number of small samples from different places, and thoroughly mix these small samples together.

2. *Location of Equipment.*—The tests should be performed in a well lighted position but not in direct sunlight. It should, of course, be close to the neutralizing vats in a butter factory and to the cheese vats in a cheese factory. It has sometimes been noticed that the equipment is located in a small cupboard or dark corner of a factory where accurate tests are impossible. It is such an essential part of factory routine that provision should be made for this equipment when the factory is being designed.

3. *Accuracy of the graduated glassware.*—There are now included in the Dairy Produce Acts specifications for 9 ml. pipettes used for acidity tests. Such pipettes must be submitted to the Department of Agriculture and Stock for approval. Burettes have been noticed in factories which have been found to be inaccurate. Although no definite specifications for burettes have been made, as designs and sizes vary considerably, butter and cheese factories should, for their own protection, demand that their supply houses submit burettes to the Department for approval.

4. *The Titration Vessel.*—The ideal titration vessel is a shallow white cup or basin with translucent walls. This is hardly necessary for ordinary work for which a shallow wide-mouthed cup will be found satisfactory. A metal vessel, such as is used in butter factories for collecting cream samples, is very unsatisfactory and should never be used.

5. *The water added when testing cream.*—The water used to rinse out the pipette when cream is being tested should be neutral in reaction—i.e., it should be perfectly colourless when phenolphthalein is added to it, yet should turn pink when one drop of N/10 alkali is added to 9 ml. of water. There are a number of factories using bore or well waters which contain considerable quantities of sodium carbonate in solution. Such waters are alkaline and will neutralize at least a portion of the acidity. One case has been noticed where 9 ml. of water was responsible for neutralizing 0·09 per cent. of acidity when 9 ml. of cream was used. The acidity tests in that particular factory would therefore be about 0·09 per cent. lower than the true percentage. In another case the water was distinctly acid, due to a clarification process, and tests using this water were higher than the true percentage. Water for the acidity test should not be taken from the hot water vessel used for the Babcock Test as this may be distinctly acid. A vessel recently washed with an alkaline cleanser may be responsible for considerable alkali being added with the water. If possible, distilled water (condensed steam), or rain water should be used.

6. *Accuracy of the decinormal sodium hydroxide.*—Most factories purchase their supply of decinormal sodium hydroxide solution from supply houses.

If kept in stock for too long a period a flaky sediment is formed by the action of the alkali on the glass. This may be very largely prevented by manufacturers coating the inside of the bottles with hard paraffin wax which is unaffected by alkali.

As usually prepared, the required weight of sodium hydroxide is weighed out, dissolved in the required volume of water, and the solution is then tested and corrected. This is somewhat unsatisfactory as even the purest sodium hydroxide may contain up to 2 per cent. of sodium carbonate. This has the effect of causing the pink colour to appear and then fade rapidly although the total alkalinity may be correctly decinormal. A more satisfactory method of preparation is described later.

If the alkali solution is exposed to the air for any length of time, either by removing the stopper or allowing to stand in the burette, carbon dioxide is absorbed from the air forming sodium carbonate. Care should therefore be taken to keep the stock bottle well corked, and discard the alkali remaining in the burette after the final titration for the day.

7. *Depth of pink colour.*—The depth of colour developed during the titration has been noticed to vary considerably, depending apparently on the person performing the test. This may be due to inability on the part of the operator to detect the first tinge of pink, an insufficiency of phenolphthalein solution, carelessness, or ignorance of what is required. Some firms supply glass stirring rods in which are enclosed pink paper and the titration is supposed to proceed until the pink colour in the milk or cream matches that of the paper. This is not always successful as some milks and creams normally have a rich yellow colour and the first change of colour noticeable is more orange than pink. Probably the most satisfactory method is to have a second cup in which is placed 9 ml. of the particular milk being tested, or 9 ml. of the particular cream and 9 ml. of water, alongside the operator. By comparison the first change of colour is easily noticed.

As the pink colour only develops slowly it is necessary to have sufficient phenolphthalein present to give a distinct pink with one or two drops of excess alkali. At least 5 drops of a 1 per cent. phenolpthalein solution should be added and the same quantity should be used for each test.

8. *Effect of carbon dioxide.*—Carbon dioxide, which is also known as carbonic acid gas, seriously affects the acidity test.

When carbon dioxide is present it combines with the sodium hydroxide and forms sodium bicarbonate and sodium carbonate. As the former compound decolourises phenolphthalein, erroneous results are obtained. When fermented or gassy creams are being tested the error may be as high as 0·07 per cent., or even higher.

After cream is neutralized it is passed over the pasteuriser and the heating to which it is subjected liberates most of the carbon dioxide. If pasteurisation is followed by, or is simultaneous with, a vacuum treatment, it is probable that all carbon dioxide is liberated. It is because pasteurised cream thus contains less carbon dioxide than raw creams that the acidity following pasteurisation is generally lower than that desired. If very accurate acidity tests are desired for cream, the 9 ml. of cream and rinsings should be gently boiled for about 30 seconds. Having thus liberated the carbon dioxide the cream should be cooled and titrated as usual.

Preparation of Decinormal Sodium Hydroxide.

For those factories which have the services of a chemist available, the following method of preparation is strongly recommended. Dissolve one pound of the purest sodium hydroxide obtainable, preferably of "AnalaR" or "Guaranteed Reagent" quality, in one pound (450 ml.) of distilled water. This solution is to be allowed to stand for some days in a resistance glass vessel, or in a bottle internally coated with hard paraffin wax, securely stoppered with a rubber cork or waxed bark cork. After a few days the sodium carbonate, which is practically insoluble in such a strong solution of sodium hydroxide, will have settled to the bottom leaving the supernatant liquid clear. This clear liquor, which contains about 50 per cent. by weight of caustic soda, has a specific gravity of about 1·53, and can be siphoned off into another similar container for storage purposes. This solution is of such strength that only from 5·5 to 6 ml. is required for each litre or decinormal solution required.

When diluting this strong solution preparatory to standardising, the distilled water should be boiled and cooled just prior to use. This is to free it from carbon dioxide which it absorbs from the air. Rain water may be used, but other waters are unsuitable. The diluted solution should be made slightly stronger than decinormal, as it is far easier to dilute the solution than to add a small amount of strong alkali during the subsequent adjustment.

A known volume of a standard acid solution (N/10 or N/5) is pipetted into a titration flask, one or two drops of phenolphthalein solution added, and then titrated with the approximately N/10 alkali until the pink colour remains for some twenty or thirty seconds. (It will eventually disappear by the solution absorbing carbon dioxide from the air.) The required volume of water to be added may then be calculated as follows:—

Twenty ml. of standard N/10 acid (or 10 ml. of standard N/5 acid) required 19·1 ml. of the approximately N/10 alkali solution. If the alkali were accurately N/10 it would have required 20 ml. exactly. Say that there is 9,900 ml. of alkali solution left after the intial test. The amount of water to be added is then—

$$\frac{(20{\cdot}0 - 19{\cdot}1) \times 9{,}900}{19{\cdot}1} = \frac{0{\cdot}9 \times 9{,}900}{19{\cdot}1} = 466 \text{ ml.}$$

As a precautionary measure only 450 ml. of water should be added and the solution tested as before. When the solution is accurately adjusted at least two titrations should be made to confirm the standardization.

The solution should then be stored in tightly-corked resistance glass bottles or waxed bottles, labelled, with the date and the name of the person who performed the standardization.

Preparation of Phenolphthalein Solution.

The indicator solution is prepared by dissolving 1 gram of phenolphthalein power in 100 ml. of 90 per cent. alcohol. The alcohol need not be that known as rectified spirit, methylated alcohol, or denatured alcohol being quite satisfactory. Methylated spirits, however, should not be used for the purpose.

THE AGE OF A COW AND ITS EFFECT ON MILK.

How does the age of a cow influence the composition of its milk? This is a question often asked. From the dairyman's point of view the fat is the most important constituent, and much experimental work has been carried out to determine how the fat test varies with the age of the cow. It has been shown that, with advancing years, cows produce milk containing a diminishing percentage of fat. The variation observed is not of any serious consequence, but it is nevertheless noticeable when average figures are taken. A cow of a high testing breed, which shows an average test of 5 per cent. of fat as a young animal, will decline to about 4.5 per cent. if she continues to produce to fourteen years of age.

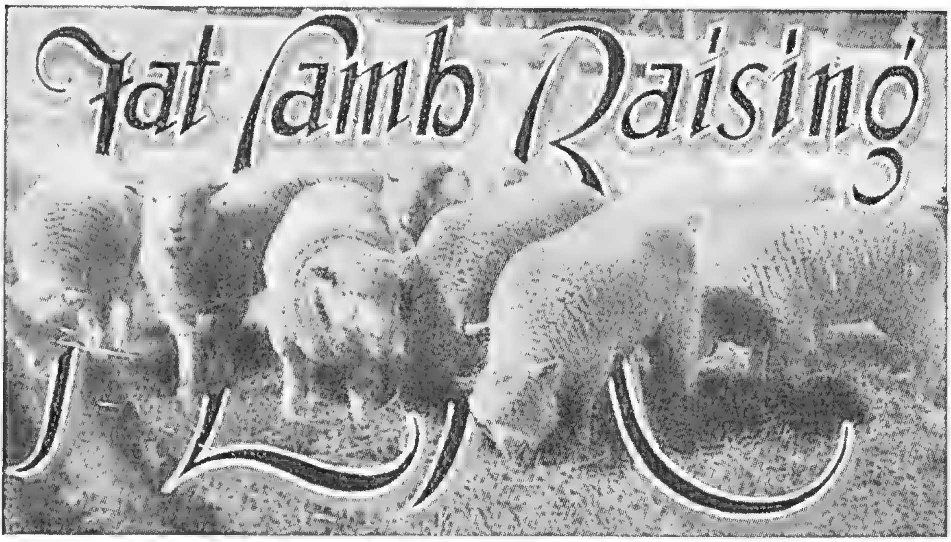
It is sometimes thought that a heifer showing a low test as a two-year-old may improve as she matures. There are no grounds for such a belief, and any farmer building up hopes of this nature is likely to be very disappointed. The richness of milk is a matter of inheritance, and so far as is known nothing can be done to change it in an individual animal.

An interesting feature with this work is that mathematicians have taken an interest in it, and one man has actually worked out a formula for calculating the fat test for any specified age, provided that the average test for the first milking period is known.

The effect of age on the other constituents of milk has also been studied and there is a decrease, with age, in all constituents except albumen, which increases slightly from year to year.

The effect of age on the fat test (richness) of milk should not be confused with the effect of age on milk production. There is a gradual increase in the quantity of milk produced from year to year until a maximum period is reached, after which the production figures show a slow decline. The age of maximum milk production for most breeds has been shown to be eight or nine years.

—*O. St. J. Kent.*



Fat Lambs in Queensland.

J. L. HODGE, Instructor in Sheep and Wool.*

QUEENSLAND can produce fat lambs as good in quality as any of her sister States or New Zealand. It is safe to say that there is no quicker money to be made out of sheep than in the production of the right type of sucker lamb. Prices during the past three years have been exceptionally good, and at the present time compare more than favourably with values elsewhere. The Department of Agriculture and Stock has more or less concentrated on fat lamb raising during the past few years, and the results have been highly gratifying. At the same time the opportunity exists for the profitable production of a great increase in numbers to the direct benefit of the farmer and the State generally.

The scarcity of the right type of crossbred ewe is one of the difficulties with which the industry is at present faced. So much is this the case that for the present the crossbred ewe may be disregarded and the presumption that a start has to be made with the merino ewe taken for granted. The best ewe for the production of fat lambs is got by the introduction of the long wools, such as Border Leicester, Romney Marsh, or Lincoln rams with the most robust strong woolled merino ewes. The ewe portion of the resultant drop should be retained as the breeding flock.

If one is fortunate enough to be able to purchase Corriedale ewes so much the better, but these, too, are difficult to come by. Here it may be stated that the few breeders of Corriedales in Queensland are allowing their flocks to become a great deal too fine in the wool. It is a common thing these days to see so-called Corriedales carrying a fleece of merino counts and not strong even at that. This is defeating the object for which the Corriedale was evolved. Properly bred, the Corriedale is an excellent all round farmer's sheep.

Although it is correct to say that in the production of fat lambs the clip from the ewes is of secondary importance, more attention may be given to the fleece with profitable results, provided always that the lambs be regarded as of major importance.

*In a broadcast talk from Radio Station 4QG (Australian Broadcasting Commission).

A properly bred Corriedale ewe is ideal for the purpose, and in addition the ewe gives a fleece of relatively high value. The Border Leicester-Merino cross also produces a nice fleece of high-yielding wool.

The Romney Marsh with the merino also nicks splendidly. All three crosses mentioned may be highly recommended as the mothers of fat lambs. On any of these crosses (the Corriedale is included for the purpose) a Downs-bred sheep should be used. Opinions naturally differ as to the best of these breeds. There is little doubt that the Southdown is the fashionable lamb at present. He is so shapely and, provided he is adequately fed all the time, he is early maturing. However, it is of importance to remember that the Southdown receives no check. Should this happen he does not compare with some of the other crosses at a more advanced age. Then again the wool from the Southdown may be almost disregarded.

The use of the Dorset horn ram is to be highly recommended. One advantage he possesses over all other breeds is the fact that he will, like the merino, work at any season of the year. All other English-type sheep mate best in the autumn and spring. The Dorset horn produces a particularly nice lamb, hardy and early maturing, and provided they are truly fat they scale well at a very early age. The wool is not high class. The use of the Border Leicester ram is to be recommended, especially when joined with merino ewes. Some buyers prefer the progeny from the merino ewe when the Border Leicester is in question, to the lamb produced from the crossbred ewe. The contention is that the merino ewe throws a lamb of greater refinement than the crossbred ewe to this particular ram. Then again the skin value is greater. For all-round purposes the Border Leicester is hard to beat, and no farmer should regret using him.

It should be the object of the farmer to produce a lamb straight off the ewe and truly fat, weighing 32 to 34 lb. at not more than four months of age. From the teat to the block should be the fat lamb raiser's slogan. To do this with any degree of certainty cultivation is essential. It is a waste of time and money to try and grow fat sucker lambs on natural grasses. Sheep in conjunction with wheat is a splendid proposition, and it is not now a question as to whether the wheat farmer can afford sheep, but rather whether he can afford to be without them. All cereals are to be recommended for the grazing of ewes and lambs. Nothing is better than lucerne, and it is surprising on what lands this highly valuable plant will grow if properly sown and looked after in the early stages of its growth. Provision should be made for winter feeding, and in this connection something definite should be done with regard to permanent improved pastures. Country in the south, which I remember as worth 30s. to £2 per acre, is to-day worth up to £12 and £15 per acre purely as the result of pasture improvement. It is unfortunate that the fencing of a property and its paddocks should be such a comparatively expensive matter where sheep of British breeds and their crosses are depastured.

Nothing less than netting of some sort will hold them, and to mention the worst breed in this connection is only guess work, unless it happens to be the breed the farmer is running. Cultivation paddocks must be securely fenced in order that they may be grazed as required, and the boundary fences must be postively sheep-proof or trouble with neighbours will occur.

A short description of the British breeds used in the production of fat lambs may be of interest.

The Southdown.

The Southdown is a mousy faced, chunky sheep of comparatively great depth and thickness, broad chest, with splendid loins and thighs. As previously explained his progeny require the best of attention with regard to feeding.

The Dorset Horn.

The Dorset horn is a bold fellow with horns placed well forward on the head, differing in this respect from the merino, with well-sprung ribs, broad chest, good loin and thigh. He is of especial value on account of the fact that he will mate at any time of the year. His lambs are hardy and early maturing.

The Border Leicester.

The Border Leicester is a fine upstanding sheep with a noble carriage, plain head and points, showing a nice square effect of body. He is particularly suited to the high lands, produces a neat, early maturing lamb, and crosses particularly well with the merino. The ewe cross Border Leicester-merino is a highly valuable type for the production of fat lambs.

The Romney Marsh.

The Romney Marsh is a sheep of large frame, black nose and preferably feet, carrying a fleece of wool finer and with more refinement than the Lincoln. He, like the Border Leicester, crosses particularly well with the merino, and the ewes got from this cross are regarded as of great value. They are fine milkers. Perhaps the greatest value in the Romney Marsh and his crosses lies in the fact that he is pre-eminently the sheep for over-wet conditions and on lands where other breeds would prove a failure. In the use of the Romney Marsh for the production of fat lambs, I prefer the blood in the ewe. A Downs ram on top of the Romney cross ewe gives a splendid lamb which is thoroughly nourished by the mother.

The Shropshire.

The Shropshire is a sheep with black face and feet, symmetrical in shape, and the producer of a very nice lamb. Where Shropshires are used it is better to market the whole of the drop, as the black is inclined to predominate, and the wool produced by this breed is not regarded with favour. The ewes used in fat lamb raising, whether Corriedale, crossbred as described, or merino, should not be allowed to get too fat before and at mating time. Good strong store condition is all that is necessary. Over-fat ewes are likely to be shy breeders, and this chance cannot be afforded where high-lambing percentages are looked for. In the condition described it is a good plan to flush the ewes on rich and succulent feed a fortnight before joining the rams. Yarding the ewes and rams three or four times a week is to be recommended. The rams, if working, should be left in for a period of six weeks. It is a good plan, if sufficient rams are at the disposal of the farmer, to hold some in reserve and join these in addition to those originally joined about three weeks after the first mating.

As previously intimated, the Dorset horns may be joined with every prospect of a successful mating at any time when the feed is good. All the other British breeds mate best in autumn and spring. Too much importance cannot be attached to the fact that all sires should be pure bred. It is commonly thought that any sires of British type are good enough for fat lamb getters. No greater mistake could be made. One has only to see a crop of lambs got by pure bred sires alongside those from

inferior animals to realise the importance of this question of pure sires. The cost of the rams should not enter into the question at all. It is safe to say the pure bred more than pays the additional cost of his purchase in the first crop of lambs. Lambs should be marketed as soon as fit. It is essential in order to achieve top prices that they should appear before buyers with the bloom on them. Too often losses are sustained by growers waiting for the more backward lambs to mature so that a large portion of the drop may be marketed at the one time. In these days of good roads and motor transport, it is an easy matter to land lambs at the yards a few hours after leaving the ewes. That is all to the good.

If conditions are such that lambs have to be driven to the rails, farmers are advised to take a proportion of the ewes with them. It must be remembered that true suckers have never been away from their mothers, and there is a grave risk of knocking the lambs about if the attempt is made to drive them on the roads without some of the older sheep to steady them. Never truck lambs in a heated condition. Never overload the truck. Never poke lambs with sticks. Remember the tenderness of a sucker lamb and handle it as such.

THE REMOVAL OF SOOTY MOULD FROM CITRUS FRUITS.

Owing to the very adverse weather conditions which prevailed in the spring and early summer, citrus growers in the coastal areas were not able to adhere to the normal spray programme. As a result scale insect infestation, particularly of the wax scales (pink wax and white wax) is now at a very high level, and, as usual, is accompanied by a copious growth of sooty mould. Even if the usual sprays were applied in the autumn, it is probable that many growers will be considerably inconvenienced by the presence of this growth on the fruit. The fungus, as most growers are aware, subsists on the sweet secretions of certain scale insects, notably pink and white wax. Except in very severe cases, it causes little direct injury to the tree, but the disfiguration of the fruit is a serious matter.

Various methods are used for the removal of sooty mould. In all of them, injury to the rind should be avoided at all costs, because it opens the way to infection with blue or green mould in the fruit. With moderate blemishes, a light brushing of the fruit will suffice. If the fruit is badly affected, brushing, sufficient to remove the mould, may seriously injure the rind. Cleaning the fruit in a rotating barrel partially filled with sawdust is a method very commonly used, but has little to recommend it. Damaged rind and bruised flesh too often result from this procedure.

If washing has to be resorted to, the fruit should be immersed for about one minute in a solution containing $\frac{1}{4}$ lb. of boracic acid and $\frac{1}{4}$ lb. chloride of lime to each gallon of water. This solution has been used extensively by growers and has been found very satisfactory. After immersion in the cleansing solution, the fruit should be well washed in clean water to avoid a whitish deposit on drying, and then should be dried thoroughly before packing.

Removal of the sooty mould by a spray before the fruit is picked is rarely practicable, and should be considered only as an emergency measure.

—*N. Caldwell.*

Poultry Feeding.

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THERE is probably no matter of greater importance to the successful poultry raiser than that of feeding. For this reason and to assist in the economical utilisation of the various foods available, poultry raisers should have a thorough knowledge of the principles underlying feeding. Although it is possible for many to buy mixed foods suitable for either egg production or the growth of young stock, it is not always advisable for the commercial poultry raiser to rely solely on these foods, for the distance from the manufacturer adds considerably to their cost; besides it may also be possible for the poultry keeper to make use of foods obtainable in different localities at lower values.

Poultry, as with all livestock, require food first for the maintenance of the bodily functions—that is, the supplying of heat and energy and repair of waste tissue, the surplus only being used for body development, or, in the case of moulting stock, the growth of feather, and in laying stock the production of eggs. It is possible, and it frequently happens, to retard the development of growing stock by incorrect feeding, and in adult stock to just maintain the birds in perfect health without procuring the desired production of eggs. It is, therefore essential for the poultry raiser to realise at the outset that under-feeding is not conducive to satisfactory results, also that the production of eggs or the bodily growth of young stock can only be obtained by feeding quantities in excess of the bodily requirements of the bird.

To attain success in poultry feeding, a practical knowledge of food values, the classification of ingredients, uses of these ingredients, and the composition of various poultry foods is necessary.

CLASSIFICATION OF FOOD INGREDIENTS.

The food ingredients are generally classified in the following groups: —Proteins, carbohydrates, fats and oils, fibre, ash, and moisture.

In addition to this classification, most careful consideration has to be given to substances known as vitamins, for it has been proved by experiment that it is impossible to obtain correct development in growing stock, or satisfactory egg production from laying hens, with a properly balanced ration of protein and carbohydrates if certain vitamins are absent. Further, the absence of essential vitamins is responsible for diseases of a malnutritional nature and the reduction of natural resistance against diseases.

Protein.

Protein is a compound built of nitrogen, hydrogen, oxygen, and a few minor constituents. During the process of digestion the insoluble proteins are converted into soluble amino-acids which are absorbed by the walls of the intestines, passing into the circulating blood, by which means they are transported to the various parts of the body to fulfil their functions. There are about twenty known amino-acids, many of which are essential to the well-being of the fowl. All forms of these acids are not found in any one class of food, consequently it is necessary to have variety in the ration in order to avoid the absence of any essential amino-acid.

As there is approximately 20 per cent. of protein in the body of the fowl (live weight), the importance of feeding an ample supply of protein can be understood, but it is not wise, in fact harmful, to feed protein-rich feeds to excess. In the first place, protein-rich foods are generally the most expensive of the food material available, and for this reason an excess is uneconomic. Secondly, protein cannot be stored in the body for future requirements. The surplus after being converted into amino-acids is divested of its nitrogen by the liver and converted into fat, and is stored as such, and the separated nitrogen voided as uric acid through the kidneys. Therefore, as well as an excess being uneconomic, it places an undue strain upon two vital organs—namely, the liver and kidneys.

Carbohydrates.

Carbohydrates are compounds of carbon, hydrogen, and oxygen. Substances such as sugars and starches are carbohydrates. During digestion these substances are broken down into simple sugars and absorbed. After absorption these sugars combine with the oxygen of the blood and are converted into carbon dioxide and water. The process of oxidation yields the heat and energy. Excess of carbohydrates are stored as fats.

Fats.

Fats are compounds of carbon, hydrogen, and oxygen. The oxygen content is about 11 per cent., whereas that of carbohydrates varies from 49 to 53 per cent. Fats and oils are chiefly used by the bird to supply heat and energy, the surplus being stored as fat. Owing to the greater quantity of oxygen necessary to oxidise fats and oils, due to its lower oxygen content, a given quantity of such substance will represent more energy than a similar quantity of carbohydrates.

Fats are not so easily digested as carbohydrates, and should not be fed to excess. As heat and energy produces, fats are worth from 1·9 to 2·5 times as much as carbohydrates.

Mineral Matter.

Mineral matter is that portion of plant or animal life that is left after burning. It is used in building up the frame, and ensures the proper functioning of body fluids. It has been established by practice that all minerals required by poultry are not present in the usual food supplied on commercial farms, also that the mineral requirement of the fowl varies with age. Only a sufficient quantity of mineral matter is absorbed by the fowl for immediate requirements, consequently a continuous supply must be fed.

Fibre.

Fibre includes the least digestable of foods, such as the outer cells of grains and fibrous matter in plants. Excessive quantity of fibre are to be avoided, as they are not only indigestible by poultry but, when excessively fed, especially in young stock, irritate the intestines.

Vitamins.

Vitamins are now known to be chemical substances, and may be classed as accessory food factors. No matter how well a ration may be balanced, without these substances satisfactory results cannot be obtained. There are five vitamins, commonly known as A, the B Group, C, D, and E.

Vitamin A may be referred to as a growth-promoting factor. It is built up by plants, and is found in green feeds, lucerne chaff and meal (commonly used as a green-feed substitute), bran, yellow maize, and whole wheat. Cod liver oil is also rich in *Vitamin A*. The absence of this vitamin in a ration fed to adult stock will cause nutritional roup and render the birds more susceptible to coccidiosis, fowl pox, severe colds, tapeworm infection, &c. Its presence in sufficient quantity will increase production, hatchability, and better development in growing stock.

It has been estimated by one authority that it is necessary to feed with bran and pollard 5 per cent. dry lucerne and 30 per cent. yellow maize meal with grain feeding in the evening of equal parts yellow maize and wheat to supply all the vitamin A necessary to good production.

The most economic form of supply of this vitamin is green feed and yellow maize, while the most convenient, in the absence of either of these foods, is 1 per cent. of a good grade of cod liver oil.

Vitamin B.—This vitamin is common to most of the foods fed to poultry, and no trouble has been recorded due to its shortage.

Vitamin C.—It was at one time thought that poultry were not susceptible to scurvy, but a recent report of an American authority indicated that growing chickens were subject to the disorder, but only after feeding a ration that would not be used commercially. This vitamin does not appear to be of importance in poultry feeding.

Vitamin D.—This vitamin, with vitamin A, is most important in the feeding of poultry. It is essential for the assimilation of the calcium and phosphorous, and naturally most important to the growing birds. This vitamin is present in abundance in cod liver oil and animal fats. Sunlight enables it to be developed in the body of the bird. With modern conditions of rearing it happens that chickens, and at times adult birds, do not get all the sunlight they should. In such cases cod liver oil can be used as a substitute. Prolonged over-feeding of vitamin D produces loss of appetite, followed by loss of weight, general ill-health, and ultimately death.

Vitamin E.—This vitamin is associated with reproduction. Investigations have shown that the feeding of rats with a ration in which this vitamin was absent brought on sterility. Sterility was cured by the feeding of small quantities of wheat germ oil. In practice breeders would guard against the possible cause of infertility by feeding good sound wheat of wheat germ oil and green food, particularly lettuce, in the ration of their breeding stock.

Digestibility of Foods.

The chemical composition of a food does not indicate its digestibility, and as regards poultry little is known on the subject. It is a question that can only be definitely ascertained by feeding experiments conducted with poultry.

Palatability of Food.

Results are not obtained by making up a ration with definite proportions of the constituents referred to later unless the fowls will eat it. If they become hungry enough they will consume a sufficient quantity of almost any food, but it will be at the cost of a very much reduced

egg yield. Upon analysis, barley is found to be a food carrying almost the right quantities of protein and carbohydrate essential for egg production, but when put into practice we find that fowls do not relish the grain, and have to be gradually accustomed to consume it. It may be as well here to mention that in making any change in the ration to laying stock, do so gradually, as sudden changes in the diet cause a reduced egg yield and frequently a false moult.

METHODS OF FEEDING.

Several methods of feeding are commonly practised, and in many instances with equal degree of success. Each method has its own advantage and appeals to the individual feeder.

The methods are known as—(1) wet mash and grain, (2) dry mash and grain, (3) and all-mash.

Wet Mash and Grain.

The mash is a mixture of different ingredients, moistened to the extent that when a handful is squeezed it will remain in mass form, and when dropped a few inches will break up into small particles. It would be more in keeping with this class of mash if it were termed "moist" instead of "wet."

With this type of feeding the mash has to be prepared daily and distributed to the birds, care being taken to feed sufficient for their requirements and not allowing any to remain unconsumed—say, after an interval of half-an-hour after feeding. The mash should be placed in shallow narrow tins or troughs, and as the food should be consumed within about half-an-hour there should be no lack of feeding space or the more timid class of bird will not procure all that she requires for maximum production.

It is usual to feed wet mash first thing in the morning and grain late in the afternoon. Many breeders reverse this order with successful results, and find that it fits in better with the daily routine.

Dry Mash and Grain.

A mash similar to that used for a wet mash is prepared dry and placed in hoppers. Birds are at liberty to consume the food at will, and although certain feeding space has been found necessary for best results the more timid fowl has a better chance of securing its requirements from a limited space than is the case in wet mash feeding. One foot of hopper space should, however, be allowed for each ten birds. The advantage of the system of feeding is that instead of mixing and feeding mash daily a quantity can be prepared and distributed once per week, and so reduce the labour of feeding. The most serious disadvantage, however, that the writer sees in this method is that the constant supply of feed encourages rats to harbour in the poultry pens.

With this system of feeding grain is usually fed during the afternoon, allowing birds ample time to scratch and find grain distributed.

All Mash.

As the name suggests, nothing but mash is fed. A suitable mixture is made and placed in hoppers. The birds have access to this food at all times throughout the day. This system of feeding possesses advantages over both the other systems previously mentioned, although it has

the disadvantage of encouraging rats. With the all-mash system, quantities of food can be placed out once per week, thereby saving the daily attention of feeding. The birds are also compelled to consume a ration suitably balanced, and from practical experience this system suggests the possibility of preventing breeds of the heavy variety putting on excessive internal fat. Production with this system of feeding is equal to any other. Fowls do not take kindly to radical changes in grain feeding, but with the all-mash system the meal of various grains may be substituted without any appreciable easing in production. Naturally, the converting of grain into meals increases the cost of feeding slightly, but the saving in labour and the assurance that the birds are being fed a ration suited to their requirements appear to justify the slight increase in cost.

THE FEEDING OF CHICKENS.

In the feeding of chickens it is most important to bear in mind that nature has provided for the first day or so of the chicken's life, as just prior to hatching the balance of the egg yolk is drawn into the abdomen of the chick. Most breeders allow at least forty-eight hours to elapse before feeding. Chickens fed earlier are subject to bowel trouble. A system of prolonged starving, however, should not be practised, as it has a weakening effect, from which many chickens do not recover.

Requirements of Growth.

Chickens make very rapid growth the early part of their life. This development is most rapid during the first six to eight weeks, consequently rations having a relatively high protein content are necessary to give the best development. From experimentation it has been definitely established that rations having a crude protein content of 18 to 20 per cent. should be used during the first six to eight weeks, and after that period reduced to 15 per cent. The protein requirement of a chicken does not alter as sharply as this, but these periods and protein content are suggested as meeting the practical requirements of the poultry raiser. Part of the protein in a ration should be of animal origin.

It is a common practice among many poultrymen to cut down the protein content after the chickens are about sixteen weeks of age, in order to delay sexual development. This, we think, is desirable if the birds are maturing too rapidly, but development can be controlled to only a very limited degree. Excessive protein feeding must be guarded against, as constant and overfeeding of protein-rich foods causes deposits of urates in the ureter, kidneys, and other organs, as well as placing an undue strain upon the liver.

It is generally conceded that milk is the most desirable protein feed for chickens and growing stock, but owing to its cost its exclusive use is not possible. Wherever possible milk should form a portion of the ration. It may be given in the form of curds, semi-solid milk, butter milk, or butter milk powder. As a drink milk is excellent, but it is objectionable owing to the difficulty of keeping chickens clean. The writers favour butter milk powder, owing to the ease with which the powder may be incorporated in the mash, thereby controlling the kind of food that each chicken consumes. It has, however, no definite advantage from a feeding value point of view apart from its concentration. Proteins build up the flesh, but at the same time a bony framework is necessary. Analysis of the chicken at different ages, according to

Halnan, indicates that it was particularly important to allow for the mineral requirement from the eleventh to the twenty-fourth week. In all experiments conducted by the Department, the increased mineral intake has been allowed for by the addition of bonemeal to the mash at eight weeks of age, and by allowing the birds free access to grit (shell and hard).

Food Consumption of Chickens.

One is often asked how much food should be given to chickens. Probably no better reply can be given than the publishing of a table from actual experiments conducted in this State.

FOOD CONSUMPTION AND WEIGHT OF CHICKENS.

Age.	Leghorns.		Australorp.	
	Weight of Chickens.	Food Consumed Weekly.	Weight of Chickens.	Food Consumed Weekly.
	ozs.	ozs.	ozs.	ozs.
Day old	1·3	..	1·36	..
1 week	1·97	1·64	2·14	1·53
2 weeks	3·31	3·36	3·61	3·32
3 weeks	5·31	4·80	5·84	5·05
4 weeks	7·61	6·46	8·68	7·20
5 weeks	9·94	7·58	12·08	6·89
6 weeks	12·92	8·96	15·86	10·62
7 weeks	16·65	8·65	20·17	13·95
8 weeks	20·41	13·29	25·31	15·05

The variation in weight from week to week and the ever-increasing amount of food required suggests the undesirability of indicating what should be supplied.

The food requirements increase week by week, and a system of feeding where the growing birds may consume all they require is the most desirable.

The all-mash method of feeding chickens by reason of the fact that the kind of food consumed is easily controlled, and that it is always in front of the birds, is suggested as being the most desirable. All-mash should be placed in shallow trays about 1 inch in depth during the first few days. The trays are then increased to a depth of 2 inches, and by the end of the first week troughs about 4 inches wide may be used. At this age chickens will commence to scratch with more vigour, scattering the feed from the trough. This can be prevented by placing a piece of netting on top of the mash loose enough to sink as consumption takes place. During the first week 8 lineal feet of feeding space should be allowed for every 100 chickens, and later increased to 12 feet. Prior to the mash being covered with netting it is important that only a little food at frequent intervals should be placed in the trays in order to avoid wastage.

In fact, the frequent feeding of all-mash appears to induce a greater food consumption, with the result of better development.

Breeders who do not desire to feed an all-mash may make use of commercial chick grains and growing mashes. These could be fed as directed by the manufacturers. It has been the custom for many poultry raisers to use scratch grain only for a short period of a

chicken's life, but in view of the more satisfactory results obtained by feeding a ration of a relatively higher protein content than chick mixtures usually have, early mash feeding appears essential.

Chickens may be reared satisfactorily upon moistened mashes and grain from about two weeks of age, but the mashes must be fed at frequent intervals. This system offers the advantage of utilising milk as a medium of moistening the mash when such is available. The feeding of dry mash, however, is suggested as a safer method of feeding, as the possibility of food becoming sour, and the probable consequent bowel trouble among chickens, is avoided.

SUITABLE ALL-MASH MIXTURE.

The following mashes have been used successfully in experiments conducted by the Department, and are suggested as a basis upon which to work. At times it may not be commercially sound to adhere rigidly and fast to the ingredients suggested, but from the table of analyses supplied it will be possible for the breeder to compound other suitable mixtures.

Ration.	1–8 Weeks.	8 Weeks to Maturity.
Maize meal	40	63
Bran	20	13½
Pollard	20	13½
Meat and Bone meal	7½	5
Dried buttermilk	10½	3½
Salt	1	1
Cod Liver Oil	1	1
Lucerne meal	..	2½
Crude protein content	17·15	14·40

REQUIREMENTS FOR EGG PRODUCTION.

The laying fowl has first to provide from her food supply for—

(1) Maintenance of vital functions;
(2) Growth requirements; and
(3) The production of eggs.

The first call upon the food supply is for that of vital functions, then growth, and any surplus nutrients are used in the manufacture of eggs. It will therefore be seen that the greater the production the greater will the consumption be, and that egg production is only possible by feeding quantities of food in excess of body requirements. It is generally estimated that a hen in full lay will consume approximately 2 ounces each of grain and mash per day. This quantity, however, will be in excess at times, and again be deficient during the period of peak production.

The majority of cereal foods available are generally deficient in protein, and in preparing a ration it is necessary to use protein-rich foods in the form of milk, milk powders, and meat meal. Protein-rich vegetable foods are available, but it has been found from experience that animal proteins give better results than vegetable. This probably is due to their greater palatability and to the fact that the range of amino-acids is wider. From practice it has been found that rations

Plate 182.

Automatic feeding hoppers in use on a poultry farm near Brisbane.

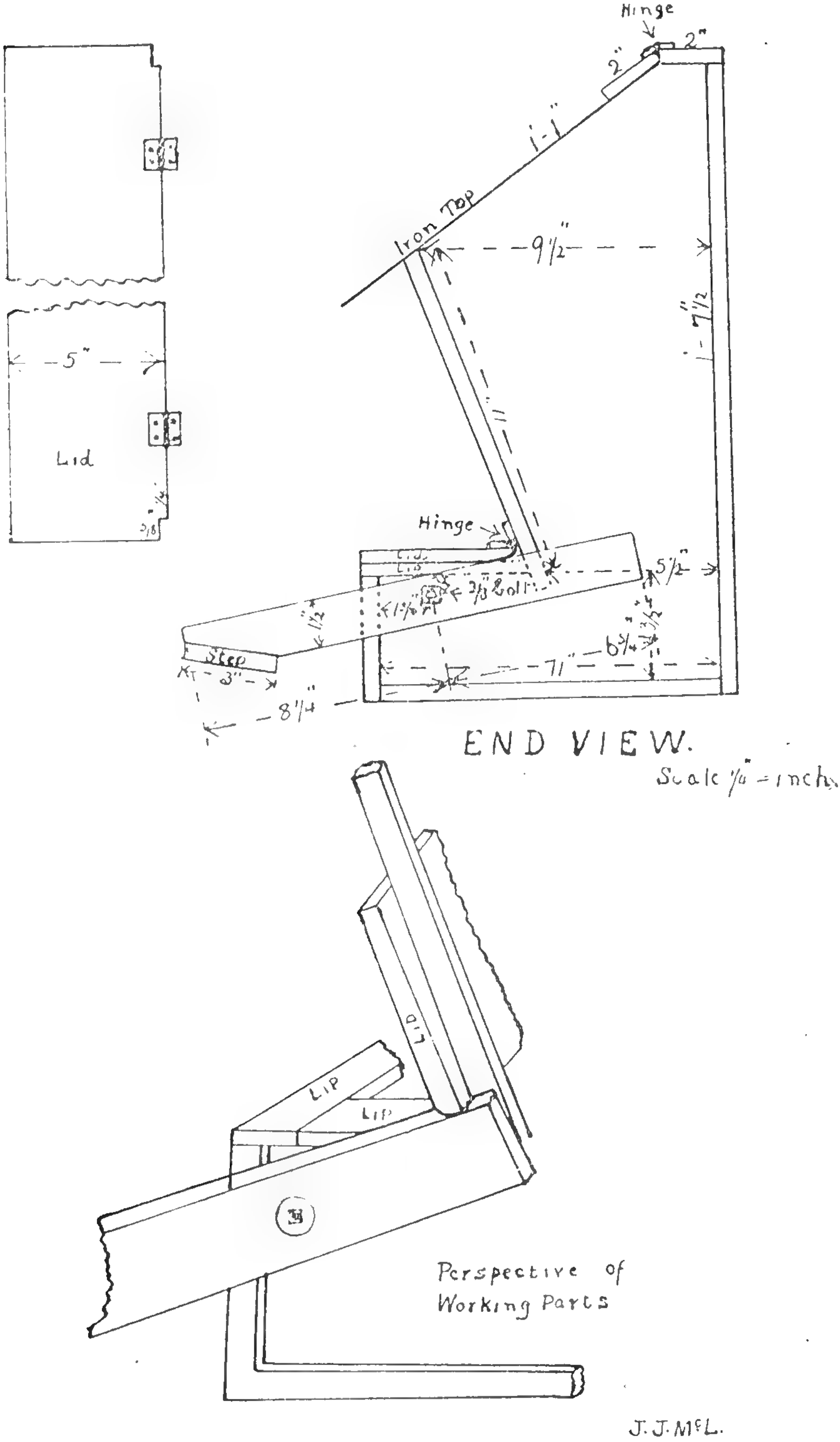

Plate 183.
Plan of automatic feeding hoppers as illustrated.

having a total protein content of slightly less than 15 per cent. give satisfactory results. As protein-rich foods are the most costly, it will readily be understood that the object of the feeder should be to use the minimum quantity necessary for maximum production.

The poultry raiser who does not desire to prepare rations himself may purchase laying mashes to be fed in conjunction with grain, also all mash. Most laying mashes contain from 17 to 20 per cent. of crude protein, and when fed in conjunction with grain, say equal parts of maize and wheat, the total crude protein content of the ration is reduced to the vicinity of from 14 to 15 per cent.

In addition to the protein and carbohydrate, the mineral content of the layers' ration has to be taken into consideration. The average amount of carbonate of lime of the egg shell is one-fifth of an ounce. To supply the requirements, say, in the mash, 4 per cent. of calcium carbonate would be necessary, but as hens not laying would only void the material it is better practice to have shell-forming material in the nature of limestone and shell grit always before the bird in separate receptacles.

Commercially, yolk colour does not appear to have as yet caused us any concern, but the consuming public do not like an excessively pale-yolked egg, and to overcome this green feed and yellow maize should form a definite part of a laying ration. Both foods are rich in vitamins, and green feed materially assists in supplying the mineral requirements of poultry. In the absence of green feed, lucerne chaff or meal should be used.

The manner in which layers may be fed varies. All systems previously referred to have proved successful. The most popular at the present time is the feeding of dry mash and grain, although all-mash is coming more into vogue. For those who desire to prepare mixtures, the following rations are suggested as a working basis:—

RATION—GRAIN AND MASH.

Mash.		Grain.	
	Per cent.		Per cent.
Lucerne chaff or meal	10	Wheat	50
Bran	28	Maize	50
Pollard	30		
Maize meal	20		
Linseed	2		
Meat meal	10		

Supplements to each 100 of mash—

½ lb. Salt.
2 lb. Sterilized Bone Meal.

All Mash.

	Per cent.
Meat Meal	5
Lucerne Chaff	6
Linseed	1
Maize Meal	30
Bran	20
Pollard	40

Supplements—

Bone meal	2 lb.	To every 100 lb. of Mash.
Salt	½ lb.	

CARE OF MOULTING HEN.

It is a common practice among breeders to give little attention to moulting birds. In many instances they receive nothing but a grain ration. Feathers contain a considerable amount of protein, and the most economical manner of getting birds back into production is to feed protein-rich foods as provided in a laying ration. Moulting may be induced by the feeding of nothing but grain at or about the time birds usually moult. When once the moult has commenced laying rations should be supplied, as it will take about a fortnight for the manufacture of the first egg after the moult is completed.

FATTENING.

Two classes of birds have to be considered—old hens and cockerels. The ability of the feeder to do much with old hens in good condition is questionable, but those slightly out of condition may be improved with ten to fourteen days' crate feeding. From experiments it has been found economical to rear cockerels to the various marketing stages on the growing rations used for pullets. Ten to fourteen days of crate feeding for these birds would undoubtedly add to their market value. As the old hens or young cockerels are to be handled they should be freed of external and internal parasites before being submitted to a fattening process. The crates could be small coops 2 feet wide, 3 feet deep, and 3 feet high. These crates hold about six birds, and if the floor is wire netting and off the ground the droppings would fall through and the birds will be kept clean. The front should be of wire or slats wide enough apart for the birds to get their heads through to feed from a trough in the front. An all-mash mixture of a relatively high protein content fed as a gruel three times a day will undoubtedly improve condition. With this system of feeding water is not necessary. Any food left over, say, after half-an-hour, should be removed in order to keep the appetite keen. A mash of equal parts maize meal and pollard, plus 10 per cent. butter milk powder and 5 per cent. meat meal, is suggested.

PREPARATION OF MASHES.

On the majority of farms the various ingredients that go to make mash are either mixed with a shovel upon the floor of the feed room or in some trough.

If the mash is to be fed wet it is a good idea to soak the lucerne chaff or meal in water over night. Just sufficient water should be used to make the mash of the correct consistency. The salt used in the mixture should be dissolved in the water first. This ensures equal distribution.

In making a dry mixture the salt should be added to the protein-rich foods in order to increase the bulk through which the salt is distributed. This action ensures an even distribution of salt throughout the mash.

Much labour will be saved and better mixing of the various ingredients ensured by using a mash mixer. An appliance that serves the purpose is easily constructed by the poultry raiser. The mixer consists of a drum constructed of 22-gauge galvanised sheet iron with tongued and grooved pine ends, as illustrated. A pipe of 1¼-inch diameter is passed through the centre of the drum, fitting into hardwood bearings at each end. This pipe can be keyed to the drum by boring a hole through the pipe close to the drum and using a piece of No. 8 wire as a key. The No. 8 wire must be bolted to the drum.

The mash is mixed by a tumbling process, and to assist in raising the mash on the side of the drum while it is revolving four battens should be attached lengthwise inside the drum 2 inches from the iron. The battens should be of 2½ by 1-inch timber.

The diameter of the drum is 3 feet 6 inches, and the length equal to the width of the iron. The sheet iron to pass around the drum must be riveted end to end, and the sides attached to the pine ends every 2 inches with screws. A convenient sized opening, the full length of the drum, must be left for filling. A sliding close-fitting door must be provided.

When using cod liver oil, an equal distribution is ensured by corporating it in the bran in the first instance.

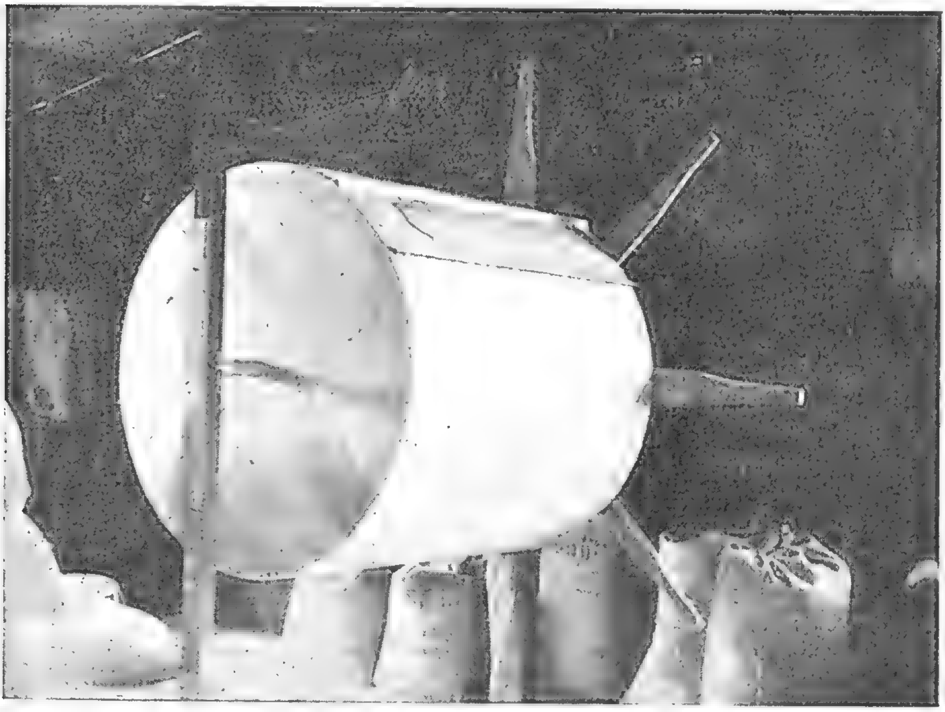

Plate 184.
A handy mash mixer.

Dry-mash Hoppers.

It is most difficult to design a dry-mash hopper that is efficient in all respects; however, the accompanying illustration will prove quite satisfactory. This hopper, being wider at the bottom than the top, tends to obviate the trouble of mash sticking which is so common in other designs. In addition, the lip on the feeding trough will prevent much wastage of mash. Such a hopper could be built in lengths to suit the number of birds, allowing 1 lineal foot of feeding space to every ten birds. The feeding space, however, could be increased where all-mash is fed by allowing 1 lineal foot to every eight birds.

Wet mash should be fed in troughs or on a sheet of iron; after the birds have consumed the mash these receptacles should be stood up to avoid contamination.

TURKEY FEEDING.

No food should be given for at least forty-eight hours after hatching. Hard grit, charcoal, and water should be the first material provided. The hard grit assists in mastication, and charcoal has no equal as a bowel corrector. Turkey chickens will gorge themselves if allowed, and this gorging is responsible for a considerable amount of trouble. Turkeys in their wild state gather their food very slowly, and it is found best to imitate them as far as possible by feeding the young chickens only a little at a time, and fairly frequently. This prevents them from overloading their digestive organs, and helps to retain that keenness of appetite which is essential to success.

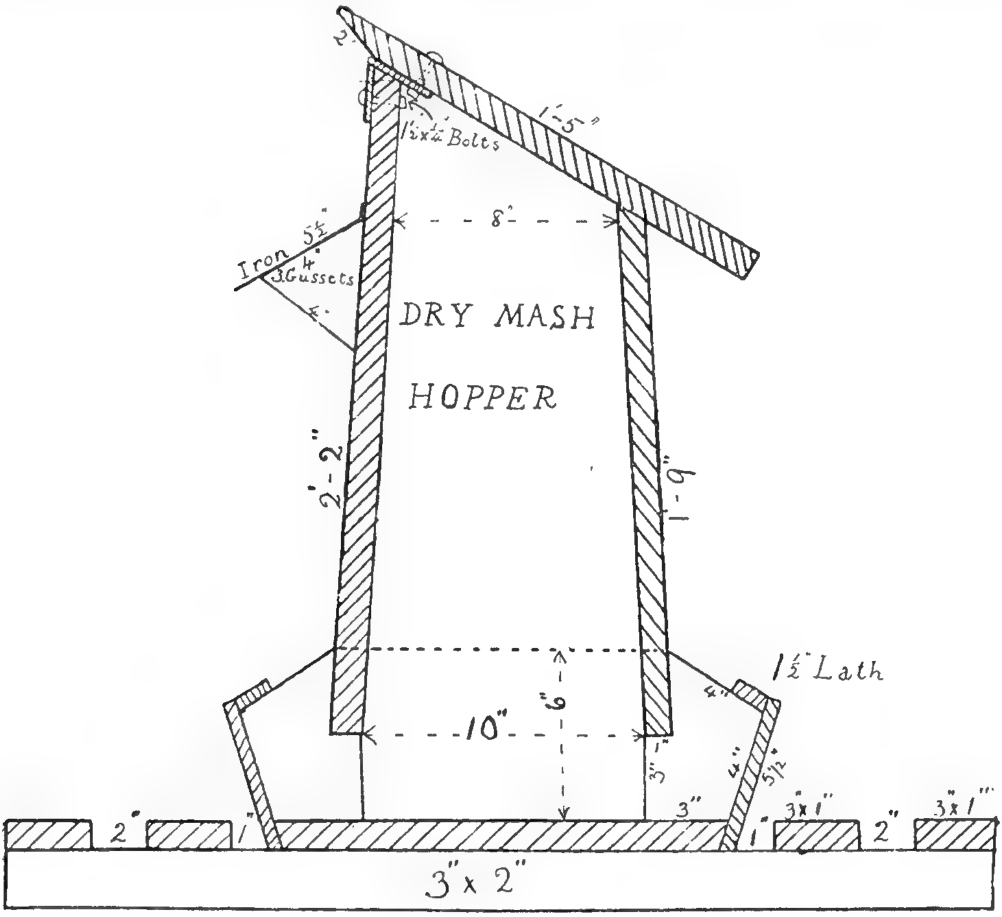

Plate 185.

Stale bread soaked in milk and then squeezed fairly dry is the most handy food on the farm, and gives excellent results. This can be fed five times a day for a few days, and variety can be added by the replacement of some of the meals with chick grains, mashes of bran and pollard mixed with milk, to which is added a small amount of minced meat, and tender green feed. This mash should be made crumbly and not sticky.

When on range the quantities of food will vary according to what they can gather for themselves, but surplus milk can be fed at all times either thick or fresh, but it is as well always to feed it in the same condition. Green feed should be fed in abundance to both growing and adult stock, but where range is allowed on good green pasture it is not so important.

Grains should always be fed at night, to induce the flocks to return to their camps. Oats, maize, and wheat are suitable for this purpose.

In the management of turkeys, especially in the rearing of young stock, cleanliness is essential. Food should not be allowed to lie about, and a strict outlook must be kept for vermin of all sorts.

DUCK FEEDING.

Ducklings require no feed for forty-eight hours after hatching.

During this period they should have water, coarse sand, and charcoal constantly before them. A mash that will give good results if fed from the first meal until they are about four weeks old is prepared by mixing together—pollard, 10 lb.; maize meal, 8 lb.; dried butter-milk, 2 lb.; bonemeal, ½ lb.; fine salt, 2 ounces. If this mash is mixed, the amount for each meal may be moistened as required. Feed several meals daily—a little, and often, is a good motto. After four weeks they could be fed a mash similar to that fed to the adults.

Adults mash—

	Per cent.
Pollard	55
Bran	25
Maizemeal	10
Meatmeal	10
Bonemeal	1
Fine Salt	½

Feed growing stock three meals daily. With adults, a small meal of whole maize could be fed in the evening in addition to the mash. In fattening ducks, cheap foodstuffs in the form of potatoes, pumpkins, &c., may be boiled and added to the mash to the extent of 40 per cent. Chaffed young greenstuff should be added, but when using other cheap foodstuffs omit it, otherwise the mash will be too bulky.

Water.

Ducks must always have access to drinking water. This is *most important* with ducklings, and the water vessels should be deep enough for them to submerge their heads. Many ducks die annually, and the cause can be attributed to lack of water.

COMMERCIAL FOODS AND THEIR FEEDING VALUE.

Barley.

Not a popular food among poultry-keepers nor do fowls consume it readily. It has a fair feeding value, but in order to increase its palatability it should be soaked or sprouted. When corn and wheat are high in price, barley may be used to the extent of 50 per cent. of the grain mixture, but the change over should be gradual.

Beans and Peas.

When whole, stock do not take kindly to either of these grains; crushed they add to the protein content of the mash, and may be used to the extent of 10 per cent.

The Grain Sorghum.

In the drier areas this crop may be grown successfully when maize or wheat are failures. They are slightly higher in protein content than maize, but do not contain the fats. Feterita and Milo are preferred, and are extensively used by some breeders with a good deal of success and economy in feeding. Some varieties of the grain, notably Kaffir corn, are credited with a binding effect, but as an offset against this plentiful supplies of green feed can be used.

Maize.

This is one of Queensland's staple grain crops of which poultry are very fond. Large grain should be cracked, but the smaller varieties can be fed whole. When purchasing maize for grain feeding, it is as well to try and secure the small grain. The quality is then easily judged, and there is no waste. Cracked grain should always be sieved before being used, and the fine powder used in the mash. Yellow corn should be used in preference to the white on account of its *vitamin A* content.

Oats.

In some places oats is one of the principal poultry foods. Most of Queensland's supply is, however, imported, and it therefore cannot be used economically in large quantities. It is, however, desirable to add variety to the ration of breeding stock by using a proportion of this grain.

Rice.

In the northern portion of Queensland, where this grain is grown, it may be possible to use quantities economically. It is a very starchy food of a fattening nature, but can be used to the extent of one-third of the grain ration. Crushed or ground rice should be used with care. It has a tendency to go rancid.

Wheat.

This grain provides the bulk of our poultry food. It is readily consumed by poultry, and can be fed as a part or whole of any grain ration, the market price of various grain foods available being the guide as to the quantities used. Plump wheats of a hard nature are of better feeding value than pinched grain or full soft grains.

Bran.

Bran is rich in protein and mineral matter, but contains a considerable quantity of fibre. This fibre is useful in adding bulk to the ration. It also assists in making a mash when fed wet of a desirable consistency. Use at the rate of up to 30 per cent. of the mash.

Pollard.

Pollard has a greater proportion of carbohydrates than bran, but not so much ash and fibre. It forms the principal constituent of mashes, and may be used to the extent of 60 per cent. of the total mash.

Maize Meal.

This meal is of especial value in fattening poultry. Some should be used in all mashes.

Ground Oats, Rolled Oats, and Hulled Oats.

Ground oats—that is, oats without the hulls—is an excellent food for both laying and growing stock. The use of these foods is largely governed by the price.

Linseed Meal.

Rich in oils and proteins, also fibre, it may be used to the extent of 2 per cent. in the laying mash, and increased slightly during the moulting period.

Cotton Seed Meal.

Cotton seed meal, on analysis, would appear to be a splendid food for poultry, but in practice the extensive use has not given good results. A good grade may be used to the extent of 5 per cent., but never exceed this quantity.

Peanut Meal.

Peanut meal is protein-rich and easily digested meal. The keeping quality of the food is poor, being inclined to go rancid, but it may be used to assist in building up the protein content of mashes.

Meat Meals.

Meat meals vary considerably in their analysis. They are essential for high egg-production. The quantities to be used vary according to conditions under which poultry are kept. In closed runs where no other class of animal food is available, they may be used to the extent of 10 per cent., but with stock on free range during periods when animal food in the form of insect life is plentiful, the quantity should be considerably reduced.

Dry Crushed Bone and Bone Meal.

These materials are essential for the development of the bony structure of young growing stock and beneficial to laying birds. Quantities up to 5 per cent. may be used. Poultry keepers who are a distance from markets may burn any bones about the place, which renders them easily crushed, and so have a supply of mineral matter suitable for feeding to young growing stock.

Milk.

If all poultry keepers had a good supply of skim milk or butter-milk there would not be such a large number of poorly developed stock. There is no better animal food for stock than milk or milk products. In a sour state it is recommended by some authorities as preventative of diarrhoea and coccidiosis. In feeding, vessels should be kept clean, and although the milk is being fed in a sour state, putrification must be avoided.

Dried Buttermilk.

This is an excellent food for those who have not the fresh product, and in a State such as Queensland, where the dairying industry is so extensive, poultry breeders should be assured of continuity of supplies. Milk and milk products appear to be a tonic as well as a food, and highly suited for laying, growing, and breeding stock. When used for the latter purposes, it has been our experience that the hatchability of the eggs has been increased. It may be used as the sole source of animal food, or in conjunction with other forms of animal food. The price will govern its use.

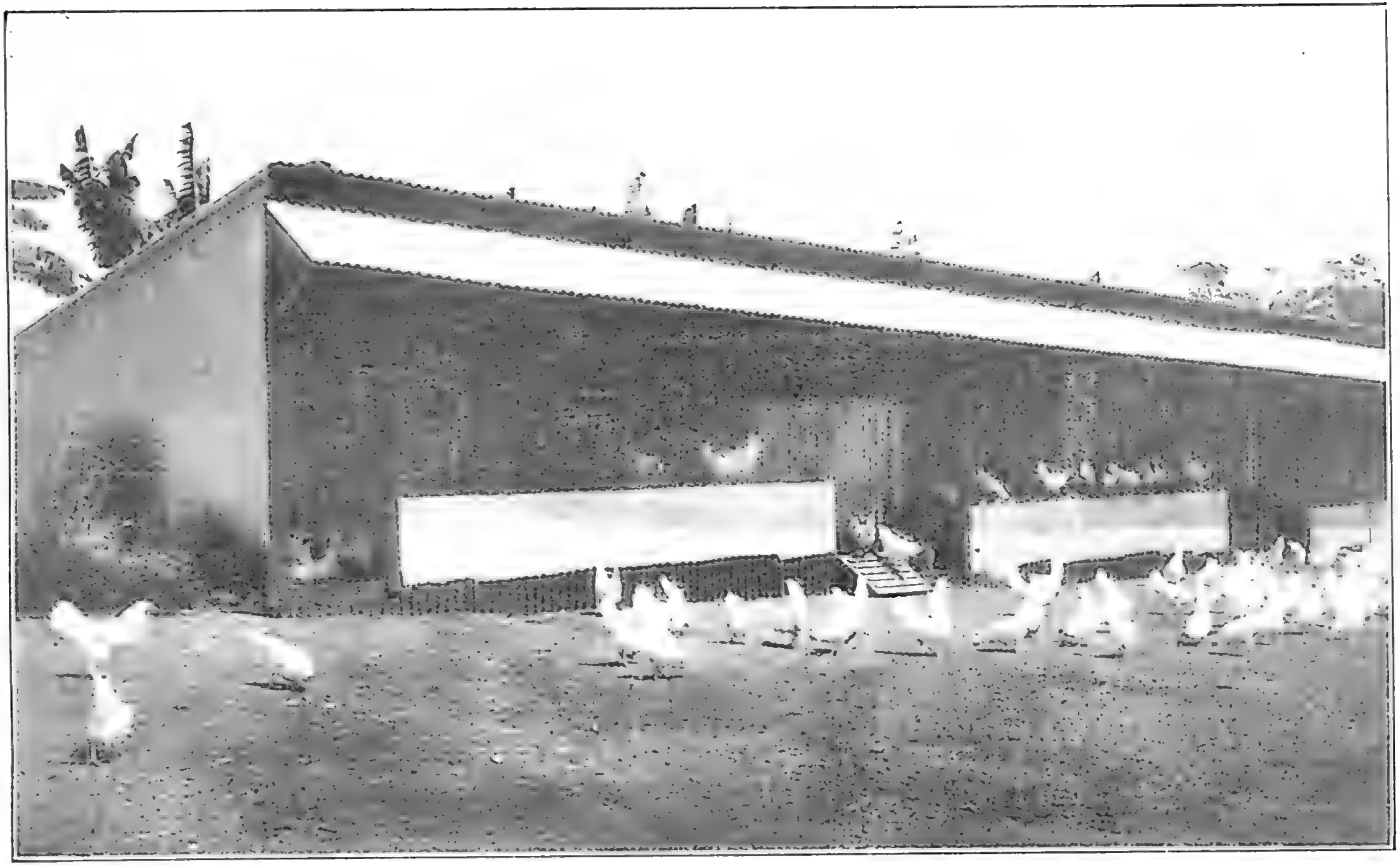

Plate 186.

An intensive laying house on a poultry farm near Brisbane, built according to the plan shown on page 169 of the February issue of the Journal.

Green Feed.

Some sort of succulent green food is essential to maintain the health and vigour of stock.

It has long been recognised as an important food for poultry, but it is only during recent years that scientists have found that green foods have been supplying an element essential to life. Green feed stimulates the liver and increases the secretion of digestive juices. The kinds of green feed most valuable and relished by fowls are the young, tender-growing portions of lucerne, lettuce, kale, rape, silver beet, barley, oats, maize, sorghums, &c. In fact, all green foods are good, but it should be young or tender. The quantity used is dependent upon supplies and general conditions. When feeding by itself, say, at midday, give the birds as much as they will eat. If used in a wet mash, the quantity could be as high as 25 per cent. of the bulk, and during droughty periods, when poultry foods are costly, green feed can be used to the extent of 60 per cent. of the mash; but when fed in these quantities, two mashes, one at 7 a.m. and one about 1 p.m., should be fed daily, followed by a grain feed, say, at 5 p.m. Poultry have not a great holding capacity, hence the necessity of feeding two mashes to enable them to deal with the bulk.

When fresh green feed cannot be obtained, lucerne chaff or meal makes an excellent substitute. This class of food, being dry, however, cannot be used to the same extent as if green. By weight, 12 per cent. should be the limit. If feeding on the wet mash, the dry lucerne can be soaked over-night with just enough water to mix the mash. This softens the lucerne and makes it more easily digested.

Grits.

Shell grit, limestone, or crushed bone should be provided. Plentiful supplies of oyster shell or ground lime should always be available, while bone may be supplied either in the form of meal or grit.

Hard Flinty Grit.

Hard pieces of rock, sand, &c., are necessary for poultry to grind their food, and should be in free supply, particularly with stock confined to pens. Without grit it is impossible for stock to digest their food thoroughly, and any system of feeding where this is not supplied is wasteful.

Charcoal.

This may be fed either in the mash or be made available to stock at all times. When it is desired to feed powdered charcoal in the mash it should be used at the rate of 2½ per cent. Charcoal is valued for its mineral content and its action as an aid to digestion.

In feeding all grit continuity of supply is essential, otherwise stock are liable to gorge themselves, with resultant troubles in the nature of distended crops, &c.

Salt.

With a good system of feeding—that is, variety and plenty of green feed—there is generally a sufficient supply of salt to meet the body requirements, but small quantities, 8 oz. to every 100 lb. of mash should be used to make the food more palatable, with the result of greater consumption and production. Salt, however, needs to be well mixed with the mash; when wet mash is fed it may be dissolved in the water, but when fed dry too much care cannot be exercised in thoroughly distributing it throughout the mash. Excessive quantities are poisonous.

COMPOSITION OF SOME POULTRY FOODS.

CRUDE NUTRIENTS.

Food.	Protein.	Fat.	Carbo-hydrates.	Fibre.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent
Barley	8·6	1·5	71·0	2·7	2·2
Beans	25·4	1·5	48·5	7·1	3·2
Kaffir corn	9·9	1·4	74·9	1·5	3·0
Maize	9·5	4·0	69·3	2·8	1·4
Oats	10·3	4·8	58·2	10·3	3·1
Rice	7·6	1·9	66·7	9·3	4·9
Wheat	12·8	2·0	67·7	2·4	1·7
Bran	15·8	2·6	56·3	9·8	4·9
Cotton-seed meal (decort.)	41·0	7·0	29·0	8·0	6·0
Linseed meal (new process)	27·2	0·8	40·7	13·9	6·2
Maizemeal	8·6	3·7	71·4	2·0	1·3
Peanut meal	47·6	8·0	23·7	5·1	4·9
Pollard	15·7	3·6	61·4	5·8	3·1
Meatmeal	54·4	8·0	6·1	..	23·5
Skim milk	3·8	0·1	4·9	..	0·8
Dried buttermilk	34·5	1·1	49·1	..	8·3
Lucerne chaff	20·7	1·4	40·9	20·0	9·0

TABLE OF WEIGHTS AND MEASURES.

In order to prepare mashes which will give maximum results it is necessary for the various ingredients to be weighed. As scales are not available on all farms the average weight of the various kinds of foodstuffs most commonly used is given for two convenient measures, the kerosene tin and the quart measure. These weights refer to the measures being filled but not pressed.

Kerosene Tin.

Bran	12 lb.	Maize (whole) ..	28 lb.
Pollard	18 lb.	Maize (cracked) ..	25 lb.
Lucerne meals ..	12 lb.	Wheat	30 lb.

Quart Measure.

	lb.	oz.		lb.	oz.
Barley meal	1	8	Linseed meal ..	1	0
Bone meal	1	12	Pollard	1	0
Bran		8	Salt (fine)	2	0
Maize (whole) ..	1	12	Wheat	1	12
Maize meal	1	8	Wheatmeal	1	8
Meatmeal	1	8			

MILK AND CREAM TESTING EXAMINATION.

An examination will be held for certificates of proficiency in milk and cream testing and milk and cream grading on Saturday, 24th July, 1937; and in butter making and cheese making on Saturday, 31st July, 1937. The examination will be held in convenient centres. Candidates should notify the Under Secretary, Department of Agriculture and Stock, Brisbane, not later than the 5th July.

Entrance fee 5s. for each subject should accompany the notification, with an additional 10s. 6d. if a special country centre is desired as the place of examination.

Candidates must not be less than 18 years of age on the day of examination.

Soil Problems, in Brigalow and Belah Country.

E. HIRSCHFELD, M.D., and R. S. HIRSCHFELD.

Subjoined is a report submitted to the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, who has approved of its publication as a contribution to a discussion on a subject of importance to Queensland farmers and graziers.

The report is especially interesting on account of its explanation of the melon-hole phenomenon. The large depressions characteristic of the brigalow melon-hole country are reminiscent of the shell holes of the war zone, and set the mind wondering what has caused them. The authors of the report seem to have hit upon a feasible explanation, which is sure to interest readers of the Journal who are familiar with the peculiarities of our brigalow country.—Editor.

BRIGALOW and belah country stands in a class of its own. Having lived on it, grazed on it, and improved it for the past eight years, we must outline first its features as we see them—features which set it apart from other types of land in the West.

1. The first thing to impress one is the density of the scrub. So dense is it that it is not easy for man or beast to make their way through it. We counted between 800 and 1,000 trees per acre. We look for a dense growth of trees in the rain forests near the coast, but do not expect to come upon it in our western lands with their limited rainfall.

2. Brigalow and belah country is practically useless for grazing purposes until it is rung. The trees are in possession of the soil, its mineral wealth, its water, and do not give grass and herbage a chance to grow. The dense scrub, however, affords shelter from westerly winds and warmth for stock during winter.

3. The peculiar formation of melon holes breaks up the level surface of the earth to such an extent that at first sight the country looks almost hopeless for agricultural purposes. The origin of these melon holes has never been explained satisfactorily. The name fits them. Many look as if they had been punched out; they average 10 or 20 feet across, are from 2 to 4 or 5 feet deep. Some melon holes are not round, but lengthwise and form small gullies 70 or more feet in length. After rain they hold water for quite a while, and are popular with the stock. Cattle seem to prefer the stagnating water in melon-holes, probably because it contains mineral matter. We found it a good plan to throw a few runners of water couch into the melon holes; they take root readily and reduce evaporation to some extent. When the hole dries up the water couch affords to stock a pleasant change from the ordinary pastures and remains green longer than the grass on the ordinary surface.

4. No other land in the west costs so much to improve; no other land will provide more employment than the brigalow and belah country. The ringbarking averages from 4s. 6d. up to 10s. an acre, according to the density of the scrub. And the man who does the ringbarking earns all the money he gets. The erection of an effective dog and rabbit-proof fence in brigalow and belah country may run to between £140 and £150 per mile. The provision for water requires the sinking of bores or making of dams.

5. The liability of the brigalow to sucker makes it risky to clear up the country for at least three to five years after it is rung. The timber fights back: the brigalow with its suckers and the belah with its seedlings.

Worst of all is the ti-tree, which runs in narrow belts and takes advantage of the country as soon as its big neighbour has died. Indeed, it is a stubborn country.

6. Once the brigalow and belah country is improved, it begins to repay the time, thought, labour, and money expended on it.

Plate 187.
TYPICAL BRIGALOW AND BELAH COUNTRY.

The outstanding feature, however, which has impressed us most is this: On the improved brigalow and belah country, as one dry spell succeeds another, stock manage to keep condition, not merely exist, in spite of the deficient rainfall. We are not over-stocked, nor are we

under-stocked. What are the qualities of this soil that enable brigalow and belah country to weather drought, and often produce a green bite, while the rest of our country is getting brown?

To try and find the answer to that question was the starting point of our soil experiments. We shall now describe how we put the question to Nature.

ARRANGEMENT OF EXPERIMENT.

Holes were sunk in the soil to different depths down to three feet, although the present experiments were confined to

(*a*) The soil on the surface;
(*b*) The soil at 6 inches below the surface;
(*c*) The soil at 12 inches below the surface.

Plate 188.
A CLEARING PROBLEM.
The bringing of Brigalow country into production is not such a formidable task as it appears at first sight. Ringbarking, poisoning with arsenic pentoxide, and the fire stick are the usual means employed.

The soil on the surface was smooth; it began to get crumbly or rather lumpy the deeper we went. After many months of westerly wind and no rain it looked bone dry. At 9 to 12 inches the small lumps showed here and there a white surface as of chalk. This was probably due to the presence of lime. The importance of this will become apparent later on.

Samples of soil were taken from each level—surface, 6 inches and 12 inches—wrapped in brown paper and taken to the homestead. We did not have the resources of a well-equipped laboratory there, but worked with the means at hand, such as they were. The soil was crushed and evened up with a rolling-pin. To make the mesh of the soil equal in each experiment, a sieve was required. A gravy colander was found to answer the purpose, and was requisitioned from the kitchen.

We had purchased a number of rain gauges, which with their graduated facing, permit of reading any change in the level of their contents; 72 cc. of each sample of soil were placed into each gauge, filling them up to the line marking 15 points. An equal quantity of rain water was subsequently added, and the results noted and tabulated in the record.

Plate 189.

A BRIGALOW FALLING "IN THE ROUGH."

A tangle of logs covering "melon-holey" ground, which, before long, will be clothed with nutritious indigenous and introduced pasture grasses:

What happens in a rain gange one and a half-inch in diameter and filled with soil artificially powdered probably differs vastly from what happens in the earth under natural conditions. This difference has always been kept in mind when interpreting the results of the experiment.

The Soil Breathes.

When a lump of sugar is dropped into a cup of hot tea, bubbles rise to the surface, as the air imprisoned within the sugar is set free. Precisely the same thing happens, when water is added to the soil in our gauges. The water as it soaks into the soil expels the air from within the soil and forces it up in bubbles. The surface soil holds more air—nearly half its volume—the deeper layers less.

Plate 190.
A LARGE MELON-HOLE ALMOST HIDDEN BY SCRUB DEBRIS.

As in the gauges, so in Nature. As the rain falls, the infiltrating water drives out air and gases from the soil, in which they had lodged. Everyone knows the smell of moist earth after a shower. The gases displaced from the soil by the rain may give rise to this smell.

How does the air get into the soil? We know, of course, that without air in the soil plant-life would not be possible. When the wind raises clouds of dust it leaves behind air in the surface layers in exchange for the particles of soil it has blown away. Yet it is hard to imagine how this air reaches the deeper layers. Gases, without a doubt, form in the soil itself. The earth is full of life: animal, plant and bacterial. Life gives place to decay, decay gives place to life. Carbonic acid and other gases are thus formed and held captive within the earth. But the bulk of the air, especially oxygen, must come from the atmosphere.

Plate 191.
A Fence-line Clearing.
Note melon-holes in the foreground.

It was not our gauges, but the observations in the paddocks, which supplied the answer as to the origin of air in our soil.

The soil shrinks in dry weather and develops cracks. These cracks are mostly found in the heavy black soil of the Darling Downs, the western plains and the brigalow and belah country, wherever there is a heavy clayey subsoil.

The man on the land hates these cracks; they are unsightly, a hindrance to agricultural operations; they are credited with preventing the growth of trees by tearing their roots, and are always associated in his mind with droughts.

Plate 192.

A SUBDIVISIONAL BOUNDARY CLEARED FOR FENCING.

Yet, we cannot escape the conclusion that these cracks are absolutely necessary for the well-being of the soil. Through them the atmosphere gains access deep down to portions of the soil, which otherwise could never be ventilated; the air breaks up the soil into lumps, crumbles and weathers it. Apart from the many huge cracks, there are found all over the country minute cracks which serve the same purpose in a smaller way.

When the rain comes the water pours down these cracks following the channels which the dry season had formed for it. Thus the rain saturates the soil from above and below. The water drives out the excess of air, although much air may be imprisoned by the rapid swelling of the soil.

Plate 193.

A Dog-proof Netting Fence is a Necessity in Brigalow Country.

In dry weather the soil breathes in air; in wet weather the soil breathes out air.

Droughts and dry spells in the West are not unmitigated evils; they really are factors that cannot be done without. And Nature takes care that they are not done without. The liberal aëration of the soil during a drought by means of the cracks creates conditions most favourable for growth as soon as the rain comes. This is probably one of the reasons why droughts are followed by bountiful seasons, despite the fact that so many of the roots must have been eaten out by the sheep, and many of the seedgrains swept away by the fierce westerly winds.

So, after all, we have to be thankful for what the dry spell does for our Western country. Let us count our blessings even during a drought.

THE SOIL EXPANDS.

We added in the gauges an equal volume of rain water to an equal volume of soil—

1. The soil from the surface swelled out by 20 per cent. (one-fifth);

2. The soil 6 inches below surface swelled out by 27 per cent. (one-fourth);

3. The soil 12 inches below surface swelled out by 33 per cent. (one-third).

Plate 194.

THE REALISATION OF A BOUNDARY RIDER'S DREAM.

The cleared track alongside the dingo- and vermin-proof fence serves as a firebreak as well as making boundary maintenance easier.

These are startling figures. That the subsoil should expand by one-fourth to one-third when thoroughly wetted appears almost unbelievable; we seem to lose the solid ground beneath our feet. Again let us remember that the earth is not encased in a gauge 8 inches high, with glass walls and glass bottom. *Before we accept such figures, we must go back to what we see in the paddocks under natural conditions.*

Two years ago, in December, 1934, after a lengthy dry spell, we had 1,116 points within ten days. It was the biggest rainfall within so short a time since we had been on Bybera. Fences were washed out, all the cracks filled up, and numerous green belahs, green pines, and an

Plate 195.
ON THE EDGE OF THE CLEARING.

enormous ironbark were uprooted. Bybera is not hilly country, it looks almost level; but measured by the altimeter there is a difference of, at most, 40 feet between the highest and lowest point. So we cannot speak of a hillside erosion.

The filling up of the cracks supplies, we submit, the certain proof that the soil swells out after rain. Washing out of fences in level country seems most unlikely to anyone knowing the gluey nature of the brigalow and belah subsoil. What really took place was that the fence-posts were partly squeezed out by the expansion of the soil and the running water may have done the rest.

It seems an extraordinary thing that a storm should have the power of uprooting green trees, especially in the West, where scanty foliage offers less leverage to the wind. Of course, brigalow and belah are shallow-rooted trees with surface anchorage; but not so the ironbark. What probably happens is this: During a dry spell, the soil shrinks and cracks, and in doing so snaps some of the tree roots. This may not

Plate 196.
A BRIGALOW-BORDERED DAM ON BYBERA.

always interfere with the well-being of the tree, but it certainly means that some of the "*moorings*" are slipped. Hence the tree is less able to resist the force of the wind, especially after wet weather, when the swelling of soil has loosened its texture.

Another proof of the expansion of the soil is furnished by the melon holes. We who live in this melon-holey country are faced all the time with the problems of this peculiar formation. It is the hole that at first takes everybody's eye and imagination. But we found on some, especially the larger holes, a marked buckling of the rim of the hole and a gentle sloping of this rim towards the level country on the far side. This seems to prove that in the making of these melon holes both shrinking and buckling of the soil are definite factors. There is another significant fact which bears out what we have just said. Most of the fallen timber in the brigalow and belah country is found around the melon holes, which are generally bridged by trees which have fallen across them. Evidently the shrinking and buckling of the soil have done their share in loosening the root-hold of the trees standing close to the melon holes.

Plate 197.

AN "OLD MAN" IRONBARK ADDS TO THE PICTURESQUENESS OF A PARK-LIKE LAND.

There can be no doubt that in the brigalow and belah country shrinkage is followed by expansion, expansion is followed by shrinkage. The soil does not stand still, but is constantly moving under the influence of the changing conditions of the weather. What happens in the paddock under natural conditions confirms the trend of our experiments, though perhaps not the extent by which the soil in the gauges swells and shrinks. The main value of the experiments lies in the fact that we have been able to establish that the soils of different levels have different rates of expansion and shrinkage.

The Soil Stores Water and Minerals.

Returning to our experiments in the gauges.—We had added more water to the samples of the different soils than these soils were capable of taking up. The surplus water was left standing on top of each sample. The appearance of the water differed with the depth of the soil from which each sample was taken. The water above the surface-soil cleared fairly quickly. The water above the samples of subsoil looked cloudy to muddy, until finally a thin film settled on the six-inch specimen and a thicker film on the soil taken from the 12-inch depth.

These films consisted of colloidal matter, and these colloids had come from the soil. As they wield such a great influence on the productivity of our western soils a brief explanation is needed.

A piece of glue when steeped in cold water takes up a lot of the moisture and swells up to great proportions. The Greek word for glue is kolla. Hence these substances which absorb water and other materials and then become sticky were named colloids or gluelike. Colloidal matter like glue when dry shows little of its stickiness; but when brought in contact with water the stickiness soon appears.

These colloids or gluelike substances are of enormous importance in Nature; both in plant and animal life. Without them life could be carried on as little as an engine could continue to run without oil. The sticky nature of our blood is due to colloids, which keep the blood corpuscles in suspension, floating about in the blood stream. But for these colloids there would be friction everywhere. They have, however, other functions as well.

It is perhaps not quite correct to say that colloids are restricted to animal and plant life. Certain minerals are also of colloidal nature, *but these minerals require protection by plant colloids to keep them in the proper colloidal state.*

The most common example of a mineral colloid is clay. On account of its colloid nature, clay when damp becomes sticky, and can be moulded by the potter. Anyone driving over black soil roads in wet weather knows the stickiness of clay clinging to the wheels. Roads are not passable till the clay has dried and become again a dry colloid. But the clay, even on the surface, holds water ever so much longer than sandy country, which is deficient in colloids. The deeper layers of black soil shielded as they are from exposure and evaporation retain their moisture longer.

The clayey subsoil, on account of its colloidal nature, is capable of holding water for a long time.

How is it that clayey soil will hold water long after the ordinary soil has parted with it? The clayey subsoil consists of a mass of fine particles surrounded by a thin film. These films act like a bladder as

soon as the soil is wetted. They admit the water while the soil is dry, and prevent its escape as soon as it is wet. They are of the same nature as the films we saw rise to the surface in the gauges.

The colloidal subsoil parts with its moisture but slowly, even when close to the surface. But plants that send their roots down to the subsoil are capable of profiting by it. Digging up Mitchell grass roots three or four feet deep is a tedious business. The soil closely adheres to the roots. The soil sticks to the root-fibres in the form of lumpy rings, which are arranged on the fibre almost like beads on a rosary. One could see how the roots had burrowed their way into the subsoil. Roots secrete carbonic acid which dissolves and pierces the film till they are free to enter and plunder the store of water, minerals, and humus laid up within.

Now vision the dense brigalow and belah country. It is an old and long untroubled land. In its virgin state this country will carry barely one beast to fifty acres. Day by day, and year by year, the leaves are falling to the ground mouldering and setting free humus and their rich mineral contents. Trees crash down and decay, enriching the earth. Now comes the rain. A heavy downpour forces water, minerals, and humus into the clayey subsoil, where they remain stored. *Thus is added that much-needed protection of organic matter which is required to keep the colloidal clay in its proper condition.*

At a depth of nine to twelve inches below the surface we found lumps of the clayey subsoil coated here and there with white chalk—carbonate of lime—which perhaps ages ago had been part of the brigalow leaves. The lime in which this country abounds is of great value; it *renders the colloidal film more resistant. Thus the brigalow and belah subsoil becomes the storehouse of water, minerals, and humus, and will continue to show green shoots of grasses long after they have vanished from the rest of the country.*

Conclusion.

Now to the practical application of the foregoing.

The brigalow and belah soil conserves moisture longer than any other country, owing to the peculiar colloidal condition of its subsoil. Of that we have ample proof. What we do not know is this: If this soil is cultivated, how deep should it be ploughed so as not to interfere with the colloidal subsoil? Only field experience can tell us.

We have proved that lucerne and prairie, Mitchell and Flinders grasses thrive on Bybera. We have never tried any cereal crop, yet the depth to which the ground ought to be ploughed is a matter that urgently requires settling. We may destroy the water-holding capacity of the colloidal subsoil by breaking it up too deeply.

The planting of lucerne and prairie grass by the grazier and dairy farmer offers great prospects. Prairie has the great advantage of being a winter grass. On Bybera it lasted longer during the drought than any other grass in the winter months. The planting of prairie and lucerne would secure feed during the winter months, and, possibly, *a continuing supply of baby beef for export.* But the burning question remains, *how deep ought we to go down in cultivating the land.*

Only the field experiment on a comparatively large scale can tell.

Fifteen to twenty million of acres of brigalow and belah country are estimated to exist in Queensland. A new kingdom waits to be conquered.

Cotton.

The favourable climatic conditions which were reported as ruling throughout all districts during April have continued through May, with the result that the cotton crops have been harvested rapidly, and excellent grades have been obtained. The volume of cotton received at the Glenmore Ginnery was so great during the early part of May that it was necessary to forward several train-loads to the Whinstanes Ginnery. An analysis of the grades of cotton being obtained at both ginneries indicates that not only is the average of the cotton of decidedly better quality than was the case during the corresponding period of last year, but there is definitely less spotting, which has resulted in a markedly higher percentage of the cotton going into the mature grades.

Although the dry conditions favoured the obtaining of cotton of high grades, the development of the top crop has been severely retarded, so that it is obvious many areas will produce only a very light top crop, if one at all. The result will be a marked reduction in the total crop that will be obtained for this season compared with what was anticipated following on the March rains.

The yields that are being obtained by farmers who have planted on newly broken up grassland indicate, however, the marked benefit that is realised where this practice is followed. In every district farmers on all types of soil are obtaining satisfactory yields from plantings even as late as mid-December on grassland in its first or second year of cultivation, whereas adjacent cotton crops on cultivations of four or more years of age are producing extremely low yields. On the average it appears that a conservative estimate of the benefit being realised by planting on grassland in its first or second year of cultivation will be at least 50 per cent. gain, and in many instances as much as 100 per cent. gain, except in the case of extremely late planted cotton. Many crops on old land will not produce 300 lb. of seed cotton per acre, whereas adjacent crops in the first year following grassland are producing as much as 700 lb. per acre, and in a few outstanding instances around 1,000 lb. Undoubtedly all cotton growers should practise the grassland-cotton rotation, especially as the newly-sown grass paddocks on the old cotton cultivations have given clearcut evidence this season of producing heavier yields of grass, and of greater feed value, than have adjacent old

grass paddocks. As most cotton growers practise dairying as well, the grassland-cotton rotation is of marked assistance to them in their two major industries.

Sugar.

Weather conditions for the month of May were not at all favourable for cane growth; warm and cool weather alternated, but no beneficial rains were received in any area.

It now seems certain that the provisional estimate of a month ago must be substantially modified. This is particularly true for the Central and Southern areas. A more accurate forecast will be available in the course of a week or two.

STACKING SILAGE.

The best results are obtained by building stacks at the latter end of summer, when suitable crops such as maize and sorghums are available, and using the silage during the winter or spring months. Stack silage is not intended to last indefinitely, although it has been known to keep for several years in a well-built stack without serious deterioration. The essential points to observe in stack silage building will therefore be of interest.

The site should be naturally drained and, where possible, close to the crop, the dimensions of the base being estimated on a basis of 54 cubic feet to the ton, allowing for a height of 15 feet in the completed stack. Shallow drains are then opened around the site, using the earth removed for levelling off. For a rectangular stack, a framework is constructed 15 feet high, using poles 17 feet 6 inches long and 5 to 6 inches in diameter at the butts. The poles should be placed 2 feet in the ground at intervals of 3 feet. An extra pair of uprights is erected 1 foot from each end of the stack framework to hold the crosspieces which support the ends of the fodder before trimming. The framework is braced on all sides, in addition to the top centre, twitching securely close to the top of the uprights.

For hand work it is convenient to construct a whip hoist, using a clamp to prevent slipping at the point of suspension.

Before stacking, place a 1-foot to 2-foot covering of waste green grass on the ground as a foundation, stacking thereon, keeping all the stalks laid lengthwise with the stack. Load from alternate sides each day, placing the ends of the fodder well over the supports, reversing heads and butts with each layer.

As stacking proceeds, a board is placed flush with the stack end uprights, trimming off surplus fodder and throwing it back on to the top of the stack, taking care to see that no crossing of stalks occurs.

After the first two days, stack a minimum of 2 feet 6 inches each day, keeping the centre high, as heating soon causes the silage to settle. The layers are stacked so as to avoid bumps, placing fairly straight stalks along the sides, then firming down and joining heads or butts at the posts. After each day's work weighted wires are placed over the stack to assist the settling.

When finished to a full camber, a layer of soft green grass is placed on top and watered well, after which the framework of logs holding the weighting material can be placed in position. If earth is utilised, a minimum thickness of 1 foot should be used on top of the stack, topping off with bush hay held by weighted wires.

—*H. W. Ball.*

Celery Growing.

H. BARNES, Director of Fruit Culture.

CELERY is classed as a cool climate crop, and it is probably mainly on this account that Queensland orchardists have never given it serious consideration. It is a crop also which demands very exacting care and attention to detail. Increasing quantities of celery, chiefly grown in South Australia, are being used in Queensland, and there appear to be prospects of producing at least a portion of local requirements on alluvial flats in the Stanthorpe district.

In the *Journal of The Department of Agriculture of South Australia* for January, 1937,* and in the *New South Wales Agricultural Gazette* for April and May, 1937,† appeared articles on celery growing in those States, and the following information is largely extracted from those articles. The blocks also have been kindly loaned by the South Australian Department of Agriculture, and copies have been made of illustrations in the New South Wales Agricultural Gazette.

"Celery, known botanically as *Apium graveolens* (Linn), is indigenous to Britain, Europe, and the temperate parts of Western Asia, Africa, California, and New Zealand; the garden form has been grown by the French since the seventeenth century."

"From the indigenous types, modern delectable strains have been raised, and today are used for salads, soups, and as a cooked vegetable. The edible portion is the enlarged leaf stalk, this stalk usually being bleached white by exclusion of the sunlight."

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* "Celery Growing," by N. R. Quinn, Assistant Horticultural Adviser, Jour. Dept. Agric. South Aust., Vol. XL., No. 6, Jan., 1937.

† "Grow Celery for the Sydney Market," by John Douglass, H.D.A., H.D.D., Senior Agricultural Instructor, The Agric. Gaz. of N.S.W., Vol. XLVIII., Parts 4 and 5, April-May, 1937.

SOIL.

"The greater portion of the celery produced in South Australia is grown on the Adelaide Plains within 10 miles of the capital, where the crop does well on all types of soils, comprising deep red sand in the western district, alluvial silt on the banks of the River Torrens, chocolate loam overlying a stiff red clay, and the stiff black Bay of Biscay soil at the foothills of the Mount Lofty Ranges."

For the guidance of Queensland growers, it is emphasised that the soil should be very rich, particularly in organic matter, and a good supply of water for irrigation should be available.

In the United States, where celery growing has assumed enormous proportions, practically the whole of the crop is produced on reclaimed swamp lands, which are composed almost wholly of decayed organic matter.

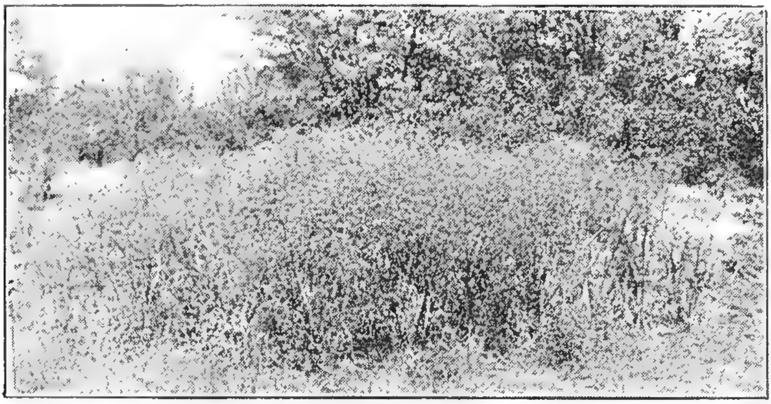

Plate 198.
Selected celery heads for seed.
[*Photo.: E. W. Pritchard, S.A. Jour. Ag.*

CLIMATE.

"The climatic conditions on the Adelaide Plains are regarded as being most favourable to the growth of celery—warm sunny days with low humidity being frequent during the growing period."

SEED.

Seed selection plays an important part in the celery industry in South Australia. "A majority of prominent growers have by careful selection of seed built up strains of their own which are not obtainable from seedsmen. The usual method of selecting seed is to mark well-shaped and vigorous plants in the field at the time of harvesting. When convenient, these selected plants are transplanted to a place in the garden where they will not be disturbed until the seed has matured in January or February. Seed matures too late for use in the following year's crop and two years supply is usually kept in hand. The plants selected for supply of seed should be sprayed consistently to reduce 'Leaf Spot' infection. When the seed has matured, it should be thoroughly dried by spreading on canvas sheets, and when dry placed in airtight containers until required. Owing to the possibility of carry-over of Leaf Spot on seed, it is a good practice to disinfect the seed in some manner. One method of disinfection is known as the hot water treatment."

Hot Water Treatment for Disinfection.

"The required amount of seed for the season's planting is placed in a muslin bag and submerged for ten minutes in a large vessel containing water heated to a temperature of 136 deg. F. (The maintenance of the temperature is very important.) After removal from the hot water the seed is placed in cold water for two minutes. Seed intended for planting at some future date should be thoroughly dried prior to storing. The hot water treatment has been reported to retard, and also reduce the germination slightly. (J. C. Niell, N.Z. Journal of Agriculture, vol. 46, page 289.)"

"There are approximately 60,000 seeds in an ounce of celery seed, and approximately 75 per cent. is usually germinable."

Plate 199.
The seed-bed.

[*Photo.: E. W. Pritchard, S.A. Jour. Ag.*

The Seed-bed.

"Fresh soil of an open textured nature should be used if possible for the seed-bed in order to avoid trouble with root fungus diseases such as 'damping off.' The seed-bed should be thoroughly prepared by working in heavy applications of decayed organic matter several weeks before the time of planting the seed. The bed should be kept well watered to permit weed seeds to germinate, and be periodically forked over, reducing the soil to a fine tilth. If it is not possible to use fresh soil for the bed, partial sterilization may be achieved by treating the soil with a solution of formalin consisting of 1 pint of formalin in 6 gallons of water, distributed evenly over 24 square feet. This method will prove more effective if bags saturated with the solution are placed over the treated seed-bed to retain the active fumes. The bed should remain thus covered for forty-eight hours, and sowing of the seed should not take place until all fumes have disappeared after several days. Dissipation of the gas may be hastened by loosening the surface of the treated bed."

When completed, the soil in the seed-bed should have been worked down very finely.

Sowing the Seed.

"The difficulty of sowing such fine seed evenly over the bed may be overcome by mixing it with whiting or by sprinkling it with an ordinary household pepper-pot. When the seed is evenly distributed over the seed-bed, it is covered very lightly, first, with fine soil, and then with a mulch of stable manure. Watering should be carried out daily during dry periods."

"First seedings in South Australia take place during September and October, and extend into January and February in order to make provision for a continuous supply of seedlings. During the growing period the seedlings must be weeded and sprayed with 6:4:50 Bordeaux Mixture. When the seedlings are from eight to ten weeks old, the tops are cut back and the tap roots are cut before planting out in the field." (N. R. Quinn S.A. Journal of Agriculture.)

Outlining the conditions in New South Wales where a first seeding is made in August, Douglass† recommends that the seed be planted in shallow furrows, spaced 6 inches apart. These furrows are ¼-inch deep, and are made by pressing the edge of a board into the soil. The board is flopped over on its other edge for the next furrow. If the board is 6 inches wide, the furrows will be spaced correctly. The seed, after being sown thinly, is then covered by dragging the edge of the planting board across the bed, and the soil is then firmed over the furrows by pressing it with the flat of the board. The bed is watered thoroughly with a fine spray, and then mulched with rotted manure. If the weather is fine it is then watered each morning to assure a supply of moisture in the surface soil. "Germination will take place in one week during warm weather, and up to three and a-half weeks in frosty weather.

Some growers place light hessian covers over the beds in hot weather to protect the plants from sun scald. It is much better practice, however, to irrigate regularly, even twice daily, and grow hardy seedlings in the sun, than to risk soft, cover-grown seedlings, which may be destroyed by hot weather at a later date.

Should the seed come up thickly in the beds, the plants should be thinned out. In the United States the growers prick out the seedlings into other beds in order to obtain sturdy plants suitable for transplanting. The furrow or row method of sowing the seed does away with this operation.

PREPARATION OF THE LAND AND MANURING.

Several textbooks on the subject of celery-growing refer to the necessity for heavy applications of rotted animal manure—up to 25 tons per acre—to the land. In New South Wales, poultry manure is regarded as good for this crop in heavy soils, although equal parts of poultry and cow manure are more suitable for open textured soils.

It is realised that growers may find some difficulty in obtaining sufficient supplies of animal manures, and in this event the land should be enriched in organic matter by growing and turning under bulky green cover crops. The Queensland Agricultural Chemist refers to the necessity of using large quantities of well-rotted stable manure, and, in addition, the use of a heavy dressing of an artificial fertiliser of the formula 4:8:10, using about 6 cwt. per acre previous to planting out,

and two or three top dressings of 1 cwt. each; or instead of the ready-mixed fertiliser, the following mixture may be used with advantage, per acre:—

2 cwt. sulphate of ammonia,
3 cwt. Nauru phosphate-superphosphate mixture,
1½ cwt. muriate of potash,

at the time of planting, followed by two top dressings with a mixture per acre of

1 cwt. nitrate of soda,
1 cwt. superphosphate,
½ cwt. muriate of potash.

Plate 200.
Celery planted out in the field in double rows.
[*Photo.: E. W. Pritchard, S.A. Jour. Ag.*

In South Australia it is advised that, in addition to the basal dressing of 20 to 25 tons of stable manure, the young seedlings require dressings of some nitrogenous artificial manure from time to time. The gardener has to use his experience in this matter, and no definite programme can be set down. Celery is a voracious feeder, as can be seen from the large number of feeding roots that develop from a healthy vigorous plant. The usual dressings of nitrogenous fertiliser are from 3 to 4 cwts. of sulphate of ammonia per acre. This is distributed along the rows as close as possible to the rooting system, lightly hoed in, and followed by an irrigation. The growth of the celery plants after replacement in the field should never receive a check as a result of insufficient moisture or plant food.

Planting.

The seedlings are large enough to plant when 4 inches high, the tap root being removed and the tops cut back before setting out. If the soil is inclined to dryness at the time of planting, the seedlings should be watered as soon as possible after placing.

Some difference of opinion exists in regard to the best method of planting. In South Australia the double row system of planting is most commonly used, and is as follows:—The seedlings are set in the soil with a "dibber," and are placed 10 inches apart in double rows also 10 inches apart. The seedlings are not placed directly opposite each other in the double rows, but are staggered. The double rows are spaced 3 feet apart in the field. This system of planting necessitates approximately 26,000 plants per acre. The double rows of plants are set out in a shallow furrow to facilitate irrigation.

Plate 201.
The method of planting celery in single rows.
—*N.S.W. Ag. Gaz.*

In New South Wales, it is contended that, in that State, double-row planting is responsible for poor ventilation between the rows, encouraging the development of both fungous and bacterial diseases and leading to the production of much second-grade celery. Single-row planting is recommended for preference. The seedlings are set out in rows spaced 3 feet apart, the plants being spaced 6 to 8 inchs apart in the rows. The drills should be struck out and 4 cwt. of superphosphate and 2 cwt. of sulphate of ammonia per acre worked into the soil. If irrigation is available, it is advisable to run water down the drill before setting the plants out. The seedlings are usually set into the mud no deeper than 2 to 3 inches below the original soil level. The objection to deep planting lies in the danger of the plants being destroyed by disease, which attacks the stem and heart when covered with soil. It is a mistake to trench celery in this country.

Cultivation.

Once the young seedlings have been planted it is upon subsequent cultivation and care that the success of the crop depends. The plants must be kept growing vigorously all the time. A stoppage of growth, due to lack of moisture or other cause, is liable to result in hollow stems, pithiness, premature seed formation, loss of quality, and excessive stringiness. Regular watering, therefore, is of the greatest importance in fine weather.

Furrow irrigation is considered preferable to overhead spraying. In New South Wales, in the early stages of growth, flooding three times weekly is advocated during fine weather; and, in the later stages of growth, it is absolutely necessary to water twice a week to maintain quality. It is stated by Douglass that the ideal practice is to make a water furrow right down the rows close to the plants in the early stages of growth. As the plants develop the furrow can be re-made until it is out in the middle of the land between the rows of plants. This method not only encourages the spread of the roots, but also enables the farmer to cultivate between the rows, thus creating a dusty, dry mulch which is an advantage. Single-row planting and the furrow method of watering a crop allows the grower most effectively to spread and work fertiliser into the soil.

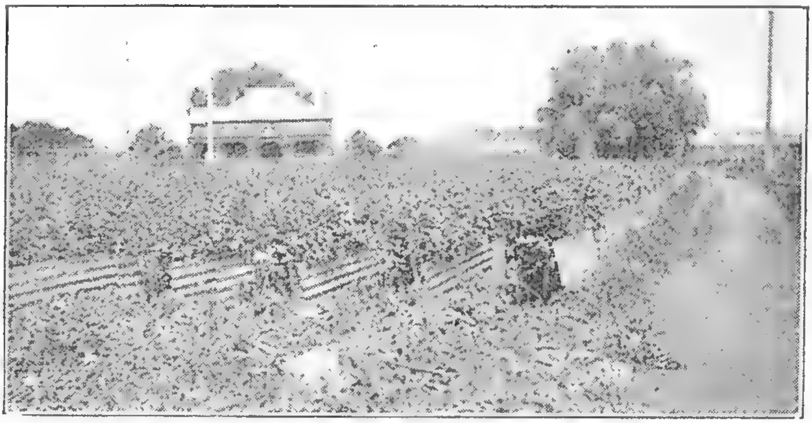

Plate 202.
Celery "Boarded-up."

[Block: S.A. Jour. Ag.

BLANCHING.

Celery is approximately a five months crop. When it is about three weeks from maturity, the light should be excluded from the leaf stalk in order to effect blanching. The old method of hilling up the soil round the stalks is not now practiced. The usual method is to place light-proof boards on each side of the rows. The boards are pressed in tightly against the plants and held in position by stakes driven into the soil. Sometimes sheets of corrugated galvanised iron are used, the sheets being cut in half lengthwise. New South Wales experience of galvanised iron, however, is that in that State it is too heating, and causes physiological defects as well as encouraging fungous and bacterial diseases.

The board method is recommended as likely to be most suitable for Queensland. Boards should be about 12 inches wide and 12 feet long, and may be made of old or second-class timber. Widths of less than 12 inches may be nailed together with laths. The method of fixing the boards is described in New South Wales as follows:—"Lay the boards flat on either side of the plant rows, force the inside edge against the plants and then raise to a vertical position, bringing up all outside leaves and trash. The boards, which are then parallel with the celery between them, are kept in position by means of a wire clip or short stake. Tarred paper is also extensively used for blanching and has proved fairly satisfactory."

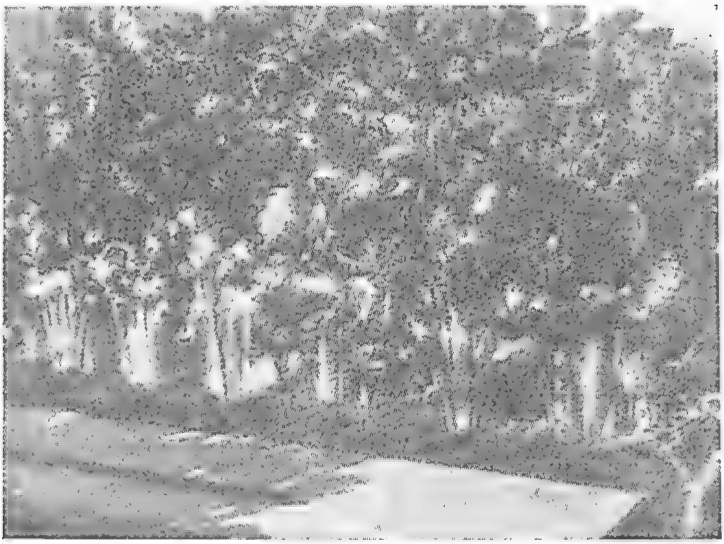

Plate 203.
Celery blanched with boards, N.S.W.

N.S.W. Ag. Gaz.

Following boarding, the practice is to apply a dressing of nitrogenous fertiliser such as nitrate of soda between the rows and to water heavily every three days. It will be found that the nitrogen and the water force the heart leaves and stems up through the boards which exclude the light and produce the blanched effect.

The celery is usually boarded up for two or three weeks, the vigour of the plant at the time of planting governing the actual period. If the plants are boarded up for a longer period, the stalks become pithy and greatly reduce the quality of the product. It will thus be noted that only the quantity of plants which can be marketed each week should be boarded up at one time. The following week another lot of the plants

Plate 204.
Harvesting celery.

[Block: S.A. Jour. Ag.

Plate 205.
Stripped heads (left); unstripped on right.
[*Block: S.A. Jour. Ag.*

should be boarded up with a second lot of boards. The third week probably some of the boards removed from the first boarded plants could be used, as after removal of the boards the plants are ready for immediate harvesting.

HARVESTING.

The method of harvesting is to cut the plant off at ground level with a sharp spade or knife where the outer leaf stalks stool out from the plant. The outer ragged leaf stalks are stripped off until the remainder has an attractive appearance. The outer leaves are of poor quality. After stripping, all soil is washed from the plants.

The celery imported from South Australia is usually packed in cases about the size of the local tropical fruit case, i.e., $24\frac{3}{4}$ x 12 x 12, though the boards are spaced to allow ample ventilation. If provision is made for the latter requirement, the tropical fruit case would serve for local market.

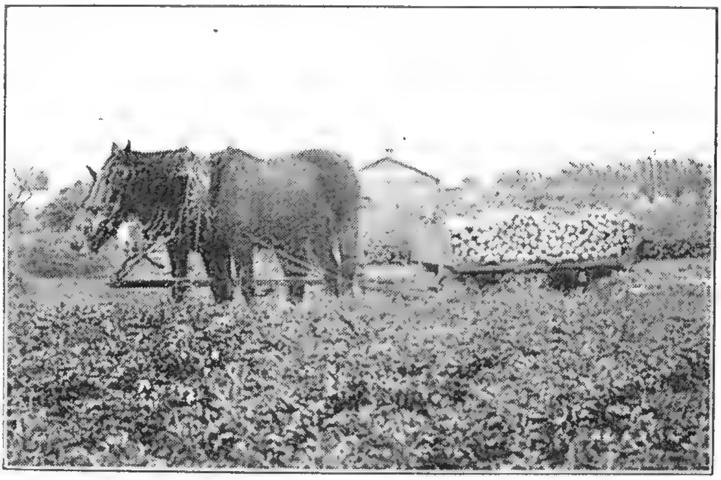

Plate 206.
Carting celery to the packing shed.
[*Block: S.A. Jour. Ag.*

Plate 207.

Field Officers of the Fruit Branch.

Front row (left to right)—Messrs. S. F. Kajewski, M. A. Hannigan, E. L. Miles, E. L. V. Filer, K. King, S. C. Schindler, E. S. Keehn, E. P. Williams, J. R. Horsley.

Seated (left to right)—Messrs. W. C. Armstrong, J. H. Gregory, R. L. Prest, S. E. Stephens, H. Barnes (Director), H. J. Freeman, W. J. Ross, H. St. J. Pratt, H. Collard.

Back row (left to right)—Messrs. H. G. Crafts, F. L. Jardine, A. M. Richardson, E. F. Duffy, C. N. Morgan, K. D. Hoffmann, H. Grimes, P. Mitchell, J. H. Mitchell, J. McG. Wills, W. E. Hamley, C. G. Williams, W. G. Hancock.

VARIETIES.

Varieties recorded by Douglass as suitable for New South Wales conditions and which may be worth trial in this State are:—

Export White—This is the long Adelaide type. It is a non-hearting variety with exceptionally long, clear stems which blanch to a fine golden-cream colour. It is outstandingly disease resistant under Australian conditions.

Golden Self Blanching—An American heart celery from Eastern U.S.A., where it is grown without blanching boards. The heavy outer leaves give enough protection with slight soil hilling to give perfect blanching. This celery is of outstanding quality, but it is rather subject to Chocolate Leaf Spot.

Golden Plume—Very similar to Golden Self Blanching, is reputed to be of French origin. This variety is slightly better quality than the lastmentioned variety and is much stronger in stem.

Utah—A green-stemmed celery of outstanding disease resistance which should do well in this country. The stems are fibrous, medium in length, and have a strong characteristic flavour.

Fruit Marketing Notes.

JAS. H. GREGORY, Instructor in Fruit Packing.

DURING the past month values for most fruits have been maintained. The continued dry weather is, to a great extent, retarding the development of large-sized fruits. Custard apples and strawberries are now coming into season, adding variety to the excellent range of fruits available in Brisbane.

BANANAS.

Bananas have reached high prices on all markets, growers finding it hard to decide which market actually will give the best returns. The dry conditions experienced over the last twelve months have increased the supplies of the smaller grades. Much under-grade fruit is being marketed, very often being used as fillers or peg bananas in the centres of the packed cases. Numerous lines of undersized fruit have been removed from the market. The inclusion of a smaller grade of fruit for local market supplies is now receiving consideration. The inclusion of a smaller grade will necessarily mean the strictest enforcement of the standard, and nothing under the minimum size prescribed will be allowed on the market.

Brisbane prices were—For Cavendish, sixes 10s. 3d. to 14s., sevens 11s. 6d. to 16s., eights and nines 15s. 6d. to 16s. 6d. per tropical case; prices for bunch fruit, Cavendish, ranged from 2½d. to 8½d. per dozen, and Lady's Fingers from 5¾d. to 9d. per dozen.

In Sydney prices ranged for sixes from 14s. to 17s. per tropical case, sevens 17s. to 19s. per tropical case and 7s. to 11s. per bushel case, eights 19s. to 21s. per tropical case and 10s to 12s 6d. per bushel case, and nines 21s. to 23s. per tropical case.

In Melbourne prices for bananas in tropical cases were—sixes 14s. to 16s., sevens 17s. to 18s., eights and nines 19s. to 20s.; and in the bushel case, sixes 10s. to 11s., sevens 11s. 6d. to 12s., and eights 12s. to 13s.

Consignments in bushel cases showed satisfactory results on the Melbourne market, but were very unsatisfactory in Sydney. It is apparent that the wholesale trade on these markets does not show any enthusiasm for suggested improvements to the grower's end of the handling.

PINEAPPLES.

Pineapple values are sound. With the advent of the cool weather closer attention must be paid to maturity of the fruit.

Prices for Smoothleaf pines in Melbourne ranged from 10s. to 15s. per tropical case, in Sydney, from 8s. to 14s., and in Brisbane 5s. to 10s.; loose fruit in Brisbane sold at from 1s. to 6s. per dozen. Ripleys brought from 6s. to 9s. per case, and 2s. to 5s. per dozen.

PAPAWS.

Good quality papaws are scarce, and well-coloured fruit is meeting with a ready demand. Brisbane prices for Yarwun fruit were from 10s. to 12s. per tropical case, for Gunalda fruit 6s. to 7s. per bushel case, and for locals 4s. to 6s. per bushel case. In Sydney prices ranged from 10s. to 12s., while in Melbourne, although up to 20s. per large case has been obtained, prices are now easier at from 14s. to 18s.

CUSTARD APPLES.

Increased supplies of custard apples are now on the market, with a consequent easing of prices. Prices in Brisbane ranged from 3s. to 3s. 6d. per half-bushel, in Melbourne from 3s. to 5s., and in Sydney from 4s. to 5s. Green immature fruit which ripens black is not wanted on any of the Interstate markets.

AVOCADOS.

A steady demand is maintained for avocados on Brisbane and Melbourne markets, with prices ranging from 7s. 6d. to 10s, and from 12s. to 13s. per half-bushel respectively.

CITRUS FRUITS.

Good quality oranges are still in short supply and sell readily, but lemons lack a firm demand.

Oranges.

Brisbane prices for Commons were from 7s. to 9s., for Navels, from 8s. to 11s., and for Benyenda fruit, from 11s. to 14s. per case. In Sydney local Navels sold at from 6s. to 10s.

Mandarins.

Brisbane prices—Glens, Gayndah 10s to 13s., Benyenda 14s. to 16s., local 7s. to 13s., Emperors 6s. to 10s., Scarlets 7s. to 10s., Fewtrells 6s. to 8s. Melbourne prices were from 9s. to 14s. per bushel.

Lemons.

Brisbane prices for Gayndah fruit were from 7s. to 11s., Benyenda 11s. to 14s., and locals 6s. to 9s.; Sydney prices were from 3s. to 9s. per bushel.

Grapefruit.

Brisbane prices were from 6s. to 8s. per bushel, and Melbourne prices from 7s. up to 13s. per bushel for special quality.

Cumquats.

This fruit realised in Brisbane from 4s. to 5s. per half-bushel case.

BERRIES.

Prices for Cape gooseberries were generally from 6d. to 8d. per lb.

Prices for strawberries ranged from 8s. to 18s. per dozen boxes, with special quality berries higher.

DECIDUOUS FRUITS.

Plentiful supplies of apples are arriving from the South. Values are not high although steady returns are being received by growers.

Apples.

Prices were as follows—Granny Smith, Stanthorpe, 6s. to 9s., Southern 6s. to 8s., Jonathan 6s. to 8s., King David 5s., Alfristan 5s., Cleopatra 5s. to 7s., French Crab 5s. to 7s., Sturmer 5s. to 7s.

Pears.

Winter Cole 6s. to 9s., Winter Nelis 7s. to 10s., Packham's 6s. to 8s., Gleau Morceau 6s. to 8s., Josephine 9s. to 10s.

Grapes.

Ohanez and Cornichon sold at from 8s. to 10s. per case.

PASSION FRUIT.

In Brisbane up to 9s. per half-bushel case was obtained for specials, while first grade fruit ranged from 6s. to 7s., and second grade from 4s. to 5s. Sydney prices were from 3s. to 7s. per half-bushel case.

TOMATOES.

Increased supplies have reduced the price considerably during the last month. Growers would be well advised to keep green fruit off the market. Ripe fruit realised from 2s. 6d. to 4s. per half-bushel, coloured fruit from 3s. to 4s. 6d., and green fruit from 2s. to 4s.

VEGETABLES.

Beans sold in Melbourne at from 10s. to 20s. per 50 lb., or from 2½d. to 5d. per lb. In Brisbane, 3s. to 4s. per sugar bag was obtained for choice quality, and 1s 6d. to 2s. 6d. for small and second quality.

Brisbane prices for lettuce were from 6d. to 1s. per dozen.

PUBLICATIONS.

"Banana Packing" is now available, while pamphlets on passion fruit, strawberry, and peach marketing are in the press. Copies may be obtained free upon application to the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane, B.7.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled during the month of April, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Lemon Grove Ruby 7th	J. Phillips, Sunnyview, Wondai	15,501·0	685·607	Dan of Greyleigh
Honey 8th of Sunnyside (365 days)	P. Moore, Wooroolin	15,955·75	647·632	Bruce of Avonel
Rosebud 7th of Oakvilla	W. G. Marquardt, Springlands, Wondai	14,859·5	609·409	Victory of Greyleigh
Fussy of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	14,331·2	537·095	Reward of Fairfield
	JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.			
Alfa Vale Gentle 2nd (365 days)	W. H. Thompson, Nanango	17,369·15	818·088	Reward of Fairfield
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
Model VI. of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	11,961·1	490·341	Reward of Fairfield
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Laura of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	13,755·7	450·54	Reward of Fairfield
College Buttercup 3rd	Queensland Agricultural High School and College Gatton	9,270·32	391·371	College Robin
Sunnyview Bess II.	C. C. Stumer, Cooranga, Mundubbera	8,226·32	285·164	Burradale, Byron
College Rascal 4th	Queensland Agricultural High School and College, Gatton	6,547·89	277·134	College Robin
	JUNIOR 2 YEARS (UNDER 2½ YEARS), STANDARD 240 LB.			
Trevor Hill Iris	G. Gwynne, Umbiram	6,748·83	263·066	North Glen Emblem

JERSEY.				
MATURE COW (OVER 5 YEARS), STANDARD 350 LB.				
Fauvic Rejoice	H. Cochrane, Kin Kin	6,992·65	407·994	Zingara King
Diamond 2nd of Southbrook	H. T. C. Gibson, Kingaroy	6,331·75	369·632	Werribee Twylish Starbright King
SENIOR, 4 YEARS (OVER 4½ YEARS), STANDARD 330 LB.				
Glenview Sultane's Majesty	F. P. Fowler and Sons, Coalstoun Lakes	10,344·35	552·569	Trinity Officer
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Fauvic Gaiety	H. Cochrane, Kin Kin	6,505·35	341·264	Oxford Ringboy
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Brooklands Royal Rosina	W. S. Conochie, Sherwood	9,135·86	417·152	Retford Earl Victor
Oxford Best's Rosina	S. H. Caldwell, Walkers Creek, via Bell	4,334·38	239·949	Oxford Best
GUERNSEY.				
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Lilac Pearl	W. R. Snell, Peeramon	6,817·15	297·653	Spurfield Bruce

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Barley Mitchell Grass.

L.D.C. (Brisbane)—

The specimen forwarded from Hughenden represents a form of the barley Mitchell (*Astrebla pectinata*). This particular species of Mitchell shows considerable variation, some forms approaching in appearance the bull Mitchell, this being much smaller. In some parts of Queensland during the past year, the barley Mitchell seems to have come back in many localities; in fact, it has made its appearance in many places where we did not know it existed before.

C.F.P. (Calen)—

We have no records of pandanus being poisonous or harmful to cattle in any way, and it is not known to possess any poisonous properties. Grass trees have been suspected, at different times, of causing the symptoms reported by you, but feeding tests with grass trees in Queensland have always yielded negative results, and the theory has been that it is purely a deficiency disease due to the poorness of the country on which grass trees grow. This idea is supported by the fact that on better class forest country, grass trees have been looked on as quite an important fodder during times of drought.

Wild Tomato or Potato Bush.

A.J.R. (Oorindi)—

The specimen represents the wild tomato or potato bush, *Solanium esuriale*. It has sometimes been suspected of poisoning stock in Queensland, but actual feeding tests in New South Wales gave negative results. We have a number of solanums in Queensland, and, generally, the fruits of solanum—in the green state at any rate—can be regarded as harmful. As the fruits ripen, they usually lose entirely, or for the greater part, their poisonous properties. At Muckadilla, some years ago, this berry was blamed for losses among sheep after some days of heavy rain. Post-mortems showed the stomachs full of berries, but in that case, distinct fermentation had set up, yellow froth being most pronounced.

A plant that is reputed to cause symptoms similar to those you describe is the so-called wild sunflower of the North-west, *Medelia asperrima*. You might have a look for this in your paddocks.

Texas Grass—Guinea Grass.

N.E.B. (Kilcoy)—

The plant with the smooth leaves and pale-coloured seed-head is *Panicum bulbosum*, sometimes called Texas grass. This grass has been grown on a limited scale in New South Wales and Queensland, but is quite rare. As a matter of fact, the only plot we knew in Queensland was one at the Queensland Agricultural College.

The larger grass with hairy leaves and darker-coloured seed-head is a variety of Guinea grass (*Panicum maximum*). Guinea grass is undoubtedly an excellent fodder, but does not stand up to heavy stocking. Several varieties of this grass have been introduced in recent years, and some are said to stand grazing much better than the older types, particularly one known as green panic, and another known as *coloratum*. We think the latter is one of your particular variety.

General Notes

In Memoriam.

The death of Mr. Atkinson Robert Wilkin, which occurred at his home in Brisbane on 4th May, is regretfully recorded.

The late Mr. Wilkin was born at Tilba Tilba, New South Wales, in 1869, and was educated at the Bega (N.S.W.) High School. Twenty-six years ago he came to Queensland from New South Wales to join the staff of the Department of Agriculture and Stock (Dairy Branch) as senior instructor in cheesemaking, a position he held until his recent retirement on reaching the age limit.

He had devoted practically the whole of his career to the dairying industry, possessing an expert knowledge of cheesemaking. He was recognised as a keen judge of dairy produce and was called upon to adjudicate in many competitions throughout the State. His services were requisitioned from time to time in the official grading of Queensland products. His lengthy association and wide experience in cheesemaking enabled him to conduct with much credit the supervision of the manufacture of the largest cheese exported from this State.

The late Mr. Wilkin took a keen interest in cricket and tennis.

He is survived by his widow and six daughters, to whom deep sympathy is extended.

Staff Changes and Appointments.

Constable T. O. Hawkins (Jackson) and Constable C. G. Rattenbury (Nerang) have been appointed also inspectors of slaughter-houses as from the 15th May.

The following persons have been appointed Members of Stallion Boards for the coming year:—

Darling Downs North—J. C. J. Maunder, B.V.Sc. (Chairman), W. C. Jeffrey, and J. H. Salmon.

Darling Downs South—A. F. S. Ohman, M.V.Sc. (Chairman), Gavin Elliot, and J. H. Wall.

East Moreton—J. C. J. Maunder, B.V.Sc. (Chairman), Wm. Frood, and R. J. F. O'Bryen.

West Moreton—A. F. S. Ohman, M.V.Sc. (Chairman), Wm. Frood, and R. J. F. O'Bryen.

Wide Bay—P. F. A. Hardman, B.V.Sc. (Chairman), M. F. Yore, and H. S. Handley.

Burnett—P. F. A. Hardman, B.V.Sc. (Chairman), M. F. Yore, and H. S. Handley.

Central Coast—M. R. Irving, B.V.Sc. (Chairman), T. J. Turkington, and G. H. Stokes.

Northern Coast—M. R. Irving B.V.Sc. (Chairman), David Jackson, and W. A. Coady.

Northern—A. L. Clay, B.V.Sc. (Chairman), Gavin Elliot, and C. F. G. Collins.

Mr. O. L. Hassell, Senior Instructor in Agriculture, has been transferred from Mareeba to Atherton.

The resignation of Mr. R. W. Greville, Assistant Veterinary Surgeon on probation, Townsville, has been accepted as from the 26th June, 1937, and Mr. R. E. Churchward, Government Veterinary Surgeon, Cloncurry, has been transferred to Oonoonba, Townsville, in place of Mr. Greville.

Constables A. R. K. Pearson (Duaringa) and L. X. Skelly (Mount Mulligan) have been appointed also inspectors of slaughter-houses as from the 22nd May, 1937.

Mr. F. A. Williams, of Upper Cedar Creek, Dayboro' Line, has been appointed an honorary ranger under the Animals and Birds Acts as from the 22nd May, 1937.

Rural Topics

Feeding Dairy Cattle in Winter.

Many farmers conserve enough roughage to last their dairy herds through a severe winter, but few understand why the milkers fail to keep up production. Mastication and digestion of dry roughage use up at least 60 per cent. of the energy value of the feed. With concentrates, less than 20 per cent. is used. It follows that very often on poor quality roughage, a cow is either unwilling or unable to consume enough to meet the requirements of full lactation. The trouble might be met in two ways. Extra consumption can be stimulated by increasing the palatability of the food. Molasses thinned out with water is excellent for this purpose. Bran and other milling by-products may also be used when prices are reasonable, but it appears unlikely that, for this year, cereals or their by-products will be able to compete with other concentrates.

Seed cake preparations are excellent for dairy cattle. On account of its slightly laxative nature, linseed has found greatest favour. There is a growing tendency to replace vegetable proteins by animal protein. Meat and animal protein meals are used extensively when analyses and prices are sufficiently attractive. By consulting the registered analyses and comparing costs, the farmer can determine which product is the cheapest to buy. All farmers who have overcome the cow's natural dislike for meat and animal protein meals have been amply repaid by the money saved and by the increased production. Under certain conditions, however, it may be uneconomical to feed such concentrates. This is usually the case with poorer milking herds.

The farmer should add a mineral supplement to the ration of all milkers, as well as heavy-in-calf cows. A mixture of two parts sterilised bone meal and one of salt should be kept in a convenient place, and about one eggcupful mixed in each feed. With heavy milkers, the allowance might be doubled.

The Management of the Bull.

The bull should be kept away from the rest of the herd in a separate run which is securely fenced and provided with water and shelter. A small service yard and a crush to facilitate the handling of the bull when necessary should also be provided.

The advantages gained by keeping the bull away from the herd are:—

1. Calving can be regulated.
2. It is easier to decide whether or not the cow is in calf.
3. The bull's services are controlled and not wasted.
4. There is less likelihood of the cows having to return to the bull.

If the run is not erected alongside a road the annoyance caused by a neighbour's cows breaking into the bull or the bull breaking out is avoided. There is always the danger that other cattle may be suffering from contagious abortion or vaginitis, which are dangerous to the farmer's own herd.

Selection of Cuttings for the Propagation of Grape Vines.

Now is the time, while grape vines are still in leaf, to select and tag those vines from which cuttings are to be taken. Don't leave it to chance in the winter, and merely take the cuttings at random from a row of the variety to be propagated. Select them from vines of outstanding merit which have proved to be consistent croppers of good quality fruit over a number of years, and which have set bunches of even-sized berries, and at the same time have maintained a healthy and vigorous constitution. Avoid the runts or vines which are inconsistent croppers, and any which persist in setting their fruit in an erratic manner.

While the behaviour of the vines in the vineyard is still fresh in their minds, growers should carefully consider their planting programme, and decide which non-commercial vines are to be grafted over with better sorts.

Select varieties suited to the district, and above all don't plant more than a few new or unknown types for observation purposes.

A vineyard should be a valuable asset for many years. Careful selection of both varieties and cuttings can often save considerable expense and time in later years.

Orchard Notes

JULY.

THE COASTAL DISTRICTS.

THE marketing of citrus fruits will continue to occupy the attention of growers. The same care in the handling, grading and packing of the fruit that has been so strongly insisted upon in these monthly notes must be continued if satisfactory returns are to be expected. It is pleasing to note that citrus fruits coming on to the Brisbane market and elswhere show great improvement in grading, packing, and quality as compared with the citrus products of previous years.

Where the crop has been gathered, the trees may be given such winter pruning as may be necessary, such as the removal of broken or diseased limbs or branches, and the pruning of any superfluous wood from the centre of the tree. Where gumming of any kind is seen it should be at once attended to. If at the collar of the tree and attacking the main roots, the earth should be removed from around the trunk and main roots—all diseased wood, bark, and roots should be cut away, and the whole of the exposed parts painted with Bordeaux paste.

When treated, do not fill in the soil around the main roots, but allow them to be exposed to the air for some time, as this tends to check any further gumming. When the gum is on the trunk or main limbs of the tree cut away all diseased bark and wood till a healthy growth is met with, and cover the wounds with Bordeaux paste.

Towards the end of the month all young trees should be carefully examined for the presence of elephant beetles, which, in addition to eating the leaves and young bark, lay their eggs in the fork of the tree. When the young hatch out they eat their way through to the wood and then work between the wood and the bark, eventually ringbarking one or more of the main limbs, or even the trunk. A dressing of strong lime sulphur to the trunk and fork of the tree, if applied before the beetles lay their eggs, will act as a preventive. In the warmer localities a careful watch should also be kept for the first appearance of any sucking bugs, and to destroy any that may be found. If this is done systematically by all growers the damage done by this pest will be very much reduced.

Citrus trees may be planted throughout the month. Take care to see that the work is done in accordance with the instructions given in the June notes. All worn-out trees should be taken out, provided the root system is too far gone to be renovated; but when the root system is still good the top of the tree should be removed till sound, healthy wood is met with, and the portion left should be painted with a strong solution of lime sulphur. If this is done the tree will make a clean, healthy growth in spring.

The inclusion of a wide range of varieties in citrus orchards is to be deprecated. Even in new plantings there is a tendency to follow the same unprofitable lines. Far too much consideration is given to the vendor's description for the purchaser's appreciation of a particular variety or varieties. Individual tastes must be subordinated to market requirements, and the selection of varieties to the best available kind of early, medium, and late fruits. Amongst oranges Joppa should be placed first, Sabina for early fruit, and Valencia for late markets.

In mandarins local conditions influence several varieties, and since the introduction of the fungus known as "scab" the inclusion, particularly on volcanic soil, of the Glen Retreat and Emperor types is risky. In alluvial lands, Emperor and Sovereign (an improved Glen Retreat) are the most profitable, though Scarlet in many places is worth including, with King of Siam as a late fruit.

Land intended for bananas and pineapples may be got ready, and existing plantations should be kept in a well-cultivated condition so as to retain moisture in the soil.

Bananas intended for Southern markets may be allowed to become fully developed, but not coloured, as they carry well during the colder months of the year.

The winter crop of smoothleaf pines will commence to ripen towards the end of the month, and when free from blackheart (the result of a cold winter) or from fruitlet core rot, they are good for canning, as they are of firm texture and stand handling. Where there is any danger of frost or even of cold winds, it pays to cover pines and also the bunches of bananas. Bush hay is used for the former and sacking for the latter.

Strawberries should be plentiful during the month, provided the weather is suitable or their development, but if there is an insufficient rainfall, then irrigation is required to produce a crop. Strawberries, like all other fruits, pay well for careful handling, grading, and packing, well-packed boxes always realising a much higher price than indifferently packed ones on the local market.

When custard apples fail to ripen when gathered, try the effect of placing them in the banana-ripening rooms, and they will soon soften instead of turning black.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

JULY is a busy month for the growers of deciduous fruits, as the important work of winter pruning should, if possible, be completed before the end of the month, so as to give plenty of time for spraying and getting the orchard into proper trim before the spring growth starts.

In pruning, follow the advice given in the May number; and if you are not thoroughly conversant with the work, get the advice of one of the Departmental officers stationed in the district.

Pruning is one of the most important orchard operations, as the following and succeeding seasons' crops depend very largely on the manner in which it is carried out. It regulates the growth as well as the number and size of the fruit, as if too much bearing wood is left there is a chance of the tree setting many more fruits than it can properly mature, with a result that unless it is rigorously thinned out it is under-sized and unsaleable. On the other hand, it is not advisable to unduly reduce the quantity of bearing wood, or a small crop of overgrown fruit may be the result.

Apples, pears, and European varieties of plums produce their fruits on spurs that are formed on wood of two years' growth or more; apricots and Japanese plums on new growth and on spurs; but peaches and nectarines always on wood of the previous season's growth. Once peachwood has fruited it will not produce any more from the same season's wood, though it may develop spurs having a new growth or new laterals which will produce fruit.

The pruning of the peaches and nectarines, therefore, necessitates the leaving of sufficient new wood on the tree each season to carry a full crop, as well as the leaving of buds from which to grow new wood for the succeeding year's crop. In other words, one not only prunes for the immediately succeeding crop, but also for that of the following season.

All prunings should be gathered and burnt, as any disease that may be on the wood is thoroughly destroyed. When pruned, the trees are ready for their winter spraying.

All kinds of deciduous trees may be planted during the month provided the ground is in proper state to plant them. If not, it is better to delay planting until August, and carry out the necessary work in the interval. The preparation of new land for planting may be continued, although it is somewhat late in the season, as new land is always the better for being given a chance to mellow and sweeten before being planted. Do not prune vines yet on the Granite Belt; they can, however, be pruned on the Downs and in the western districts.

Trees of all kinds, including citrus, can also be planted in suitable situations on the Downs and western districts, and the pruning of deciduous trees should be concluded there. If the winter has been very dry, and the soil is badly in need of moisture, all orchards in the western districts, after being pruned and ploughed, should receive a thorough irrigation (where water is available) about the end of the month, so as to provide moisture for the use of the trees when they start growth. Irrigation should be followed by a thorough cultivation of the land to conserve the water so applied. As frequently mentioned in these notes, irrigation and cultivation must go hand in hand if the best results are to be obtained, especially in our hot and dry districts.

VEALER CALVES.

Provided a calf is kept on the mother to allow it to reach a live weight of about 80 lb., a satisfactory return is assured when marketed. Large numbers of calves are being slaughtered annually for export as boneless veal, and the trade has reached such proportions that buyers are usually operating in all dairying districts. Even if the mother is to be dried off early, it is well worth while to keep the calf for a few days before selling for slaughter. A calf responds quickly to a few days suckling, and this can quite easily mean the difference between an underweight and overweight calf—a matter of at least 5s. in its value.

Farm Notes

JULY.

FIELD.—Practically the whole of the work on the land for this month will be confined to the cultivation of winter crops, which should be now making good growth, and to the preparation of land for the large variety of crops which can be sown next month. Early maturing varieties of wheat may be sown during the month Florence, Seaspray, and Novo all being suitable. When seasonal rains are delayed, and the main sowing is not effected until July, the medium early varieties, such as Three Seas, Flora, Pusa, and Clarendon, may also be sown with every prospect of success, but during normal seasons it is preferable to sow such varieties prior to July. Sow late maturing varieties early and early maturing varieties late. The harvesting of late-sown maize will be nearing completion, and all old stalks should be ploughed in and allowed to rot. Clean up all headlands of weeds and rubbish, and for this purpose nothing equals a good fire. Mangels, swedes, and other root crops should be now well away, and should be ready for thinning out. Frosts, which can be expected almost for a certainty this month, will do much towards ridding the land of insect pests and checking weed growth. Cotton-picking should be now practically finished and the land under preparation for the next crop. The young lucerne should be becoming well established; the first cutting should be effected before the young plants reach the flowering stage, as although such an early mowing is seldom worth gathering, it has the effect of stimulating root growth, to the benefit of subsequent cuttings, which are usually made when approximately one-third of the plants have reached the flowering stage. If weed growth is prevalent during the spring months, frequent cutting is often necessary as a control to prevent seeding.

QUEENSLAND SHOW DATES FOR 1937.

June.

Bundaberg	3rd to 5th
Biloela	3rd to 5th
Lowood	4th and 5th
Boonah	9th and 10th
Gladstone Jubilee Show	10th and 11th
Marburg	18th and 19th
Rockhampton	22nd to 26th
Mackay	29th June to 1st July

July.

Kilcoy	1st and 2nd
Proserpine	2nd and 3rd
Bowen	7th and 8th
Ayr	9th and 10th
Rosewood	9th and 10th
Pine Rivers	9th and 10th
Cleveland	9th and 10th
Townsville	13th to 15th
Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th to 22nd
Laidley	21st and 22nd
Maleny	22nd and 23rd
Cairns	27th to 29th
Gatton	28th and 29th
Barcaldine	28th and 29th
Emerald	28th and 29th
Caboolture	30th and 31st

August.

Crow's Nest	4th and 5th
Home Hill	6th and 7th
Royal National, Brisbane	16th to 21st
Wynnum	27th and 28th

September.

Imbil	3rd and 4th
Ingham	3rd and 4th
Pomona	10th and 11th
Tully	10th and 11th
Rocklea	11th
Innisfail	17th and 18th
Malanda	22nd and 23rd

October.

Ravenshoe	8th and 9th
Millaa Millaa	1st and 2nd

November.

Murwillumbah	3rd and 4th

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

WINTER DANGERS.

COUGHS and colds and sore throats occur all the year, but are more common in winter. At this season also they are more serious and more often followed by bronchitis and pneumonia, which are formidable diseases, and may cause death even in the robust, but much more often in those who are weakly from poor nutrition or from any other cause. It must be remembered that any sore throat in a child may be the commencement of an attack of diphtheria, which also prevails most often in the colder months. Therefore, although the great majority of these attacks are mild or even trivial occurrences, many of them are dangerous, and the mortality that they cause is not inconsiderable. This is true, not only in countries that experience severe cold, but even in Queensland, whose mild winter season should be the healthiest time of the year.

It is most important that all mothers should clearly understand that all these diseases, including the "common cold," are caused by disease germs, that spread from one person to another. They are spread chiefly by those suffering from mild attacks, or who have recently recovered from an attack, but are not yet free from the infectious germs, and even by those who appear perfectly well, but are carrying these germs in their throats and noses. Whenever these persons cough, and even during speaking, these germs are thrown out in a fine, invisible spray, which floats around them, and so easily enter other peoples' throats or noses. Another method of spread is due to the bad habit, unfortunately so common in children, of putting their fingers in their

mouths or to their noses, and smearing the secretions containing the germs on to other children's hands and faces. Babies should be protected from those who wish to kiss them.

It is easy to understand why these diseases are more common in winter, for in that season people are most crowded together in rooms often very poorly ventilated. The greatest risks are run in crowded halls, where there are sure to be some carriers of these diseases when they are prevalent. In schools also epidemics occur, and are not always avoidable, but children before school age, and especially babies, should never be exposed to unnecessary risks by taking them to picture-shows and such like. Exposure to cold by itself can never cause these troubles, though it may temporarily lower the resistance of those who may happen to be carrying the germs in their throats. In young children these diseases are almost invariably contracted from another person. Fatigue may also temporarily lower the resistance, and this is an additional reason for keeping young children at home in the evenings, and giving them a good night's rest.

The mother's great aim should be not only to protect her children from infection, but to increase their resistance. For this good nutrition is of the greatest importance, giving plenty of the protective foods—milk, butter, eggs, vegetables, fruit, wheatmeal, or cerevite, and in the case of weakly children cod liver oil in some form. All rooms should be well ventilated. The best sleeping places are rooms with windows wide open or verandas so long as the children are well covered and sheltered from cold winds. From diphtheria they may be protected by inoculation.

When the child is suffering from a cold or cough, unless very trivial, he should be kept in bed. This is imperative if the thermometer shows a rise of temperature. Compared with this all treatment by medicines is of comparatively small importance.

IN THE FARM KITCHEN.

STEWS, WHITE AND BROWN.

THERE are two kinds of stews—a white stew, such as Irish stew, which has a thin white gravy, or a brown stew, which has a thick brown gravy. A brown stew can be cooked on top of the stove or in the oven, whichever place is most convenient.

Stewed Steak and Dumplings.

Take 2 lb. stewing steak, flour, pepper, salt, and water.

For the dumplings, take ½ lb. flour, ¼ lb. suet, 1 small teaspoonful baking powder, water to mix. Wipe the steak and cut into six or eight pieces. Flour them well and season with pepper and salt, then put them into a casserole and cover with water. Put the casserole into the oven, bring to the boil, skim it if required, then let it simmer gently for about three hours. To make the dumplings, chop the suet finely and mix it with the flour (to which the baking powder has been added). Add cold water and mix to a stiff paste, then divide it into portions and make into dumplings. Add these to the stew when it is half-cooked, allowing them about one hour and a half. Serve the stew on a hot dish with the dumplings round.

Exeter Stew.

Take 1½ lb. stewing beef, 2 oz. dripping, 2 carrots, turnip (if liked), 1 tablespoonful vinegar, 3 onions, 1 tablespoonful flour, salt and pepper, dumplings.

Cut the meat into neat cubes and fry in hot fat for five minutes. When brown all over, remove the meat to a plate, then brown the sliced onions slightly, in the fat. Stir in the flour and season to taste and thin down with stock or water. When the mixture is boiling, return the meat to the saucepan, add the sliced carrots and turnip, cover, and simmer for two hours. Add six or eight dumplings and cook another half-hour. Serve the meat and vegetables on a very hot dish garnished with the dumplings.

Haricot Mutton.

Take 2 lb. neck of mutton, 2 carrots, 6 small turnips, 2 oz. butter (or dripping), 1 dessertspoonful flour, a little parsley, thyme, bayleaf, 1 small clove or garlic, ½ pint boiling water, salt, and pepper.

Divide the mutton into cutlets, and, if very fat, remove some of it. Heat about half of the butter or dripping in a stewpan, fry the meat quickly until the entire surface is lightly browned; sprinkle it with flour, so as to make it brown more quickly. When ready, add the boiling water, garlic, a little salt and pepper, and the parsley, thyme, and bayleaf. Cover with a close-fitting lid, and cook very slowly for one hour. In the meantime heat the remaining butter, peel the turnips, cut into thick slices, and fry them brown, then drain them and put into stewpan containing meat, also the carrots previously scraped and cut into neat pieces. Continue to cook slowly until both meat and turnips are tender, then pile the meat in the centre of a hot dish and arrange the pieces of turnip round the base. Skim well to remove some of the fat, then strain the gravy over the meat and serve.

Irish Stew.

Take 1½ lb. scrag and middle neck mutton, ½ lb. onions, 1 lb. potatoes, water, pepper, and salt.

Wipe the meat and divide into portions. Peel and slice the onions. Put them into a large saucepan with the meat, add a little pepper and salt and just sufficient water to cover it. Bring it to the boil and remove the scum from the top, then leave the stew to simmer gently for from one and a-half to two hours, keeping it skimmed as required. Peel the potatoes, wash, split into halves, and cut them across again if they are large. Place these on top of the stew (when the latter is about half-cooked) and sprinkle them with salt. When the meat is ready the potatoes should be soft. To serve the stew, place the meat and onions in the centre of a very hot dish and the potatoes round the edge to form a border. Pour some gravy round, making quite sure first that it is free from grease.

WHEAT VARIETIES.

The census of wheat varieties sown in Queensland during the 1936-37 season, compiled by the Queensland State Wheat Board, Toowoomba, disclosed the fact that Florence still maintains its position as the most popular variety with an area of 71,903 acres, representing 20·5 per cent. of the total acreage sown. This wheat has been popular for many years on account of its ability to yield well over a wide range of soils and climatic conditions. If seasonally sown, it will usually escape rust. Its chief defect is a tendency for the grain to scatter in the field when ripe, rendering it susceptible to storm damage.

Flora, a short-stemmed grain wheat of high quality, maintains its position with 41,160 acres. In this connection, it is interesting to note that Puora—a Pusa-Flora crossbred recently introduced by the Department of Agriculture and Stock—secured the championship at the recent Sydney Royal Show in the medium strong class.

The varieties Pusa, Three Seas, Gluyas, Cedric, and Seafoam are all represented by areas in excess of 18,000 acres, ranging from 10·8 per cent. of the total area in the case of Pusa, to 5·2 per cent. in regard to Seafoam.

The high proportion of superior hard milling wheats grown in Queensland—such as Florence, Flora, Pusa, Cedric, Ford, and Novo—is an interesting factor in the local wheat industry. Flora, Cedric, Novo, Seafoam, and Three Seas were all bred at the Roma State Farm, and introduced into general cultivation by the Department of Agriculture and Stock through the medium of trial plots established throughout the Darling Downs wheat areas.

—*H. W. Ball.*

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF APRIL IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and Stations.	Average Rainfall. Apr.	Average Rainfall. No. of Years' Records.	Total Rainfall. Apr. 1937.	Total Rainfall. Apr. 1936.
North Coast.	In.		In.	In.
Atherton	4·32	36	1·63	4·55
Cairns	11·36	55	6·57	9·15
Cardwell	8·87	65	0·76	11·06
Cooktown ..	8·88	61	2·01	18·66
Herberton ..	3·84	51	0·35	2·67
Ingham	7·64	45	0·59	7·02
Innisfail	20·09	56	12·47	19·10
Mossman Mill ..	8·29	24	..	5·54
Townsville ..	3·38	66	0·15	2·04
Central Coast.				
Ayr	2·49	50	0·60	2·52
Bowen	2·69	66	1·21	0·26
Charters Towers ..	1·51	55	0·03	1·70
Mackay	6·18	66	1·02	0·65
Prosperine ..	5·80	34	1·22	2·04
St. Lawrence ..	2·76	66	3·04	Nil
South Coast.				
Biggenden ..	2·19	38	0·58	0·84
Bundaberg ..	3·32	54	0·60	0·93
Brisbane	3·81	85	0·92	0·21
Caboolture ..	4·57	50	1·45	0·58
Childers	2·88	42	0·28	1·20
Crohamhurst ..	6·81	44	..	2·64
Esk	3·04	50	1·31	0·31
Gayndah	1·46	66	0·47	0·25
Gympie	3·50	67	0·54	1·14
Kilkivan	2·29	58	0·80	0·18
Maryborough ..	3·88	66	3·03	1·42
Nambour	6·32	41	1·97	2·66
Nanango	1·98	55	0·27	0·32
Rockhampton ..	2·55	66	1·58	0·20
Woodford	4·70	50	1·83	0·64

Divisions and Stations.	Average Rainfall. Apr.	Average Rainfall. No. of Years' Records.	Total Rainfall. Apr. 1937.	Total Rainfall. Apr. 1936.
Central Highlands.	In.		In.	In.
Clermont ..	1·59	66	0·94	Nil
Gindie	1·15	38	..	Nil
Springsure ..	1·54	68	0·51	Nil
Darling Downs.				
Dalby	1·40	67	0·93	0·13
Emu Vale ..	1·41	41	0·57	0·42
Hermitage ..	1·43	31	..	0·16
Jimbour ..	1·39	49	0·78	0·05
Miles	1·46	52	0·77	0·26
Stanthorpe ..	1·78	64	1·44	0·64
Toowoomba ..	2·65	65	0·85	0·68
Warwick ..	1·66	72	0·31	0·47
Maranoa.				
Roma	1·30	63	0·32	0·02
State Farms, &c.				
Bungeworgorai ..	1·20	22	..	Nil
Gatton College ..	1·92	38	..	0·34
Kairi	4·31	21	..	..
Mackay Sugar Experiment Station	4·72	40	..	0·21

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—APRIL, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure Mean at 9 a.m.	Shade Temperature. Means. Max.	Means. Min.	Extremes. Max.	Date.	Min.	Date.	Rainfall. Total.	Wet Days.
	In.	Deg.	Deg.	Deg.		Deg.		Points	
Coastal.									
Cooktown	29·89	82	72	86	24	62	20	212	5
Herberton	..	77	56	82	19	47	10	35	6
Rockhampton	29·98	84	61	87	7, 16	53	22, 25	158	3
Brisbane	30·02	79	59	85	8	54	22	92	7
Darling Downs.									
Dalby	30·01	77	48	85	1	39	25	88	3
Stanthorpe	..	70	43	80	1	32	22	144	10
Toowoomba	..	72	50	78	1, 8	44	9, 16, 20, 24	86	7
Mid-Interior.									
Georgetown	29·91	88	60	91	23	49	24	49	1
Longreach	29·98	86	55	92	27	49	21	Nil	..
Mitchell	30·03	78	45	84	1	36	21, 25	15	1
Western									
Burketown	29·91	92	65	95	2, 3, 4	58	18, 19	Nil	..
Boulia	30·02	87	60	94	25	52	21	Nil	..
Thargomindah	30·02	80	56	87	2, 3	46	25	Nil	..

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

MOONRISE.

	June. 1937.		July. 1937.		June. 1937.	July. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	a.m.
1	6.37	5·2	6.45	5·7	11·11	12·1
2	6·37	5·2	6·45	5·7	—	—
					a.m.	
3	6·38	5·2	6·45	5·7	12·10	1.3
4	6·38	5·2	6·45	5·8	1·9	2·7
5	6·39	5·2	6·45	5·8	2·11	3·13
6	6·39	5·2	6·45	5·8	3·18	4·21
7	6·39	5·2	6·45	5·9	4·25	5·25
8	6·40	5·2	6·45	5·9	5·35	6·23
9	6·40	5·3	6·44	5·9	6·39	7·13
10	6·40	5·3	6·44	5·10	7·42	7·58
11	6·41	5·3	6·44	5·10	8·36	8·38
12	6·41	5·3	6·44	5·11	9·23	9·15
13	6·41	5·3	6·43	5·11	10.6	9.47
14	6·42	5·3	6·43	5·12	10·44	10·25
15	6·42	5·3	6·43	5·12	11·25	10·58
16	6·42	5·3	6·43	5·13	11·51	11·32
					p.m.	p.m.
17	6·43	5·4	6·42	5.13	12.25	12·12
18	6·43	5·4	6·42	5·14	1·0	12·52
19	6·43	5·4	6·42	5·14	1·35	1·36
20	6 43	5·4	6·41	5·15	2·14	2·24
21	6·44	5·4	6 41	5·15	2·54	3·15
22	6·44	5·4	9·41	5·16	3·40	4·7
23	6·44	5·4	6·40	5·16	4·29	5·7
24	6 44	5·4	6·40	5·17	5·23	6 3
25	6·44	5·5	6·39	5·17	6 18	7·0
26	6·45	5·5	6·39	5·18	7·13	7·58
27	6·45	5·5	6·38	5·18	8.9	8 56
28	6·45	5·5	6.38	5·19	9·6	9·55
29	6·45	5·5	6·37	5·19	10·4	10·56
30	6·45	5·5	6·36	5·20	11·1	11·58
31			6·35	5·21		

Phases of the Moon, Occultations, &c.

2 June	☽	Last Quarter	3 24 a.m.
9 ,,	●	New Moon	6 43 a.m.
16 ,,	☾	First Quarter	5 3 a.m.
24 ,,	○	Full Moon	9 0 a.m.

On 9th June, at 6.40 a.m., the New Moon will arrive at that part of its orbit where it will be in a direct line between the Sun and Earth. Being nearest the Earth, our satellite will apparently be of the same size as the Sun; its cone-shaped shadow will entirely obscure the face of our great luminary and a total eclipse will occur within a limited area—a rare occurrence, because the Moon can wander as much as 5 deg. north or southward from the ecliptic, the apparent path of the Sun—for any one part of the Earth a very rare spectacle indeed. Unfortunately this marvellous phenomenon will not be seen in Australia, but all but our next-door neighbours in the Solomon Islands will see a partial eclipse. Further eastward the path of totality will cross the Pacific Ocean through some of the Ellice and Phœnix Islands and through Fanning and Christmas Islands, ending at the western coast of South America, near Lima in Peru A partial eclipse will be seen in the southern part of North America, Mexico, and the central part of South America from north to south. The duration of the total phase varies for different places—in this case from 3 min. 54 sec. to 7 min. 4 sec. Its path may be 150 miles wide and, incidentally, Fanning and Christmas Islands, opposite each other, lie directly on its border lines.

On the 21st June the Australian winter solstice will occur, when the Sun, having reached its greatest northern latitude, will seem to be stationary, after which it will begin to turn southward.

Venus on the 27th will attain its greatest distance west of the Sun, rising about three hours and a-half before it.

Mars, which since 14th April has been moving with retrograde motion from Scorpio into Libra, will, on the 27th, resume its normal eastward course.

Mercury rises at 4.51 a.m., 1 hour 46 minutes before the Sun, and sets at 3.50 p.m., 1 hour 12 minutes before it, on the 1st; on the 15th it rises at 4.56 a.m., 1 hour 46 minutes before the Sun and sets at 3.45 p.m., 1 hour 18 minutes before it.

Venus rises at 3,21 a.m., 3 hours 6 minutes before the Sun, and sets at 2.42 p.m., 2 hours 20 minutes before it, on the 1st; on the 15th it rises at 3.13 a.m., 3 hours 29 minutes before the Sun, and sets at 2.24 p.m., 2 hours 39 minutes before it.

Mars rises at 3.58 p.m. and sets at 5.23 a.m. on the 1st; on the 15th it rises at 2.48 p.m. and sets at 4.13 a.m.

1st July	☽	Last Quarter	11 3 p.m.
8th ,,	●	New Moon	2 13 p.m.
15th ,,	☾	First Quarter	7 36 p.m.
23rd ,,	○	Full Moon	10 46 p.m.

Perigee, 6th July, at 7 p.m.
Apogee, 18th July, at 8 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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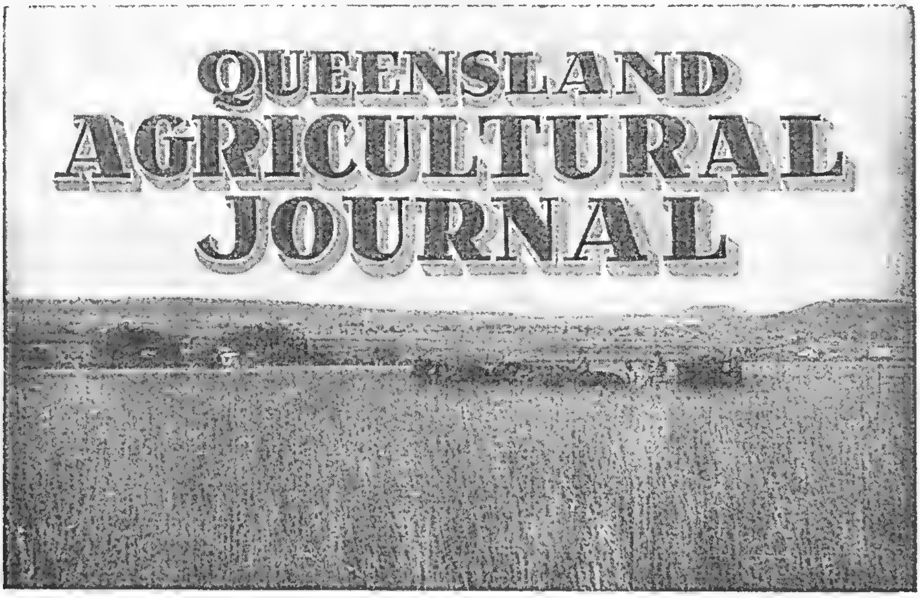

VOL. XLVIII. | 1 JULY, 1937. | PART 1

Event and Comment

The Premier's Work in London.

ON his return from his mission to Great Britain, the Premier, Hon. W. Forgan Smith, LL.D., met with a rousing reception at the South Brisbane railway station from an immense assemblage of citizens, which was representative of every section of the community. "I can assure you that I am very glad to be back here to co-operate with you all in the work of making this great State a greater State still," remarked the Premier, who then went on to say that his business in London had been strenuous work. The Federal Treasurer (Mr. Casey), the High Commissioner (Mr. Bruce), and himself, assisted by the Agent-General for Queensland (Mr. Pike) and Mr. Townsend, of the Customs Department, made a strong combination in the Sugar Conference. Australia emerged with a quota of 400,000 long tons, together with a proportionate increase each year during the agreement on any increased consumption in the free market. In addition, duties had been stabilised for five years. Queensland sugar would have a preference in the British market equivalent to 4s. 6d. a hundred-weight in Australian currency. If the British Government contemplated any alteration at the end of the five years it was pledged to give eighteen months' notice. The agreement would be of advantage to the sugar industry, and would stabilise sugar growing and allied interests in Queensland. The industry now could look forward with greater contentment, and would be enabled to view its problems in the light of known facts.

Great Britain before the war was dependent entirely on imported sugar. To-day it supplied 25 per cent. of its requirements under a bounty higher than the value of sugar on the world market. That was done as a matter of national policy. It was something for the Australian critics of the sugar industry to ponder over. Other countries also had increased their areas under beet for sugar production. Russia, for example, estimated that this year its output would be 3,000,000 tons. If this figure, given by the Russian representative at the conference, was realised, Russia would have become the largest sugar producing country in the world. A few years ago Russia did not export sugar at all. He mentioned these things to show the need for rationalisation in the sugar industry. There had been no curtailment in any way in the agreement. All would agree that the best had been done by the Australian delegation in the circumstances.

The Premier said that Mr. Casey and he had co-operated on all matters raised at the conference. There was no disagreement whatever. The result was due very largely to that co-operation. It demonstrated the advantage of the closest co-operation between the Commonwealth and the State or States concerned in negotiating any trade treaties.

All the money necessary was being found in every leading country of Europe for the armament programme, but when proposals were put forward for the conservation of human life there was great disagreement among the financial experts and economists.

"If money can be found for armaments, why is it not possible to find money for the development of a great country like Australia?" asked Mr. Forgan Smith, amid applause.

"I assert that there is no one within reach of my voice who believes in war. We want to live in amity and peace with our fellow men. The problem of civilisation is to give food, clothing and shelter for all industrious people and sufficient leisure to develop those treasures of the mind that lie latent in us all. It is along those lines that progress and development can take place whereby we can add our quota to the upward trend of civilisation.

"It is pleasing to note that Great Britain is peace minded," the Premier added. "There is no desire on the part of anyone of importance to embroil the world in another tragedy. The British Commonwealth of Nations in my opinion is the strongest influence for peace and civilisation existing in the world to-day.

"The development of peacemindedness is an essential. It is not a matter so much for a Government; governments necessarily reflect the attitude of the people, but if individuals themselves are peaceminded and support an economic and sociological policy which brings about that end then you too are contributing to the work of civilisation. . . . It behoves all people to keep their heads and understand the conditions in which they live and do their work in their allotted sphere here in Australia.

"In my travels I take particular notice of the conditions under which the people live; all the people I am interested in, all the people engaged in useful service, whether working by hand or brain or both, and I say definitely there is no country I have yet visited where better conditions obtained than in Australia," continued the Premier.

"Those things which have brought this about are not done by accident. Money does not grow annually like wattle on a bush. Those things we enjoy at present are the fruit of the work that has been done to date, but none of us can live on the past or on what we have done in the past.

"Our work is one of gradual progression and climbing ever upward towards our ideal goal so that it is our duty to preserve the measure of freedom we now enjoy and contribute our part in our day and generation to make this a better and brighter country for all our people."

Science in Dairying.

OPENING the second dairy science school for butter factory employees, which will continue in session in the dairy science laboratory, Department of Agriculture and Stock, during July, the Minister, Hon. Frank W. Bulcock, said the real basis of the future prosperity and success of the dairying industry in Australia was the degree to which appeal was made to the palate of the consumer, plus the degree to which, by technical operations and proper supervision, economic loss could be eliminated. Economic loss could largely be overcome by technical application and research. Without that technical knowledge the dairy industry could not expand to the extent that its importance demanded. The crux of the whole position was in the factory. With properly trained technical staffs in the industry they could reasonably hope to make the progress they should, if they had proper and unrestricted access to the overseas market. But unless Australia continually improved dairy production, and the levels and general gradings of dairy exports, she would be confronted not with an increasing but with a declining market.

Dairy operatives must be competent in every section and able to supply a product comparable with that shipped from other countries. There was a general recognition of the value of the technician in agriculture, and this, perhaps, applied particularly to dairy production. In the final analysis, quality determined access to the markets of Britain, and it was essential that those engaged in the export of dairy products should have a thorough understanding of the economics of the industry. Mr. Bulcock remarked further that he was sometimes apprehensive about the future of our export trade, but with the knowledge that technical excellence could be attained in every factory operation that feeling of anxiety was soon dispelled.

Red Spider.

ROBERT VEITCH, B.Sc.Agr., B.Sc.For., F.R.E.S., Chief Entomologist and Director of Research.

THE red spider* is a species of mite frequently found on a wide range of economic and weed host plants, banana, bean, cotton, cucumber, deciduous fruit, grape vine, melon, papaw, pea, pumpkin, tomato and strawberry being among the cultivated plants subject to severe infestation. This species must not be confused with the red mite, a common but relatively unimportant pest of deciduous fruit. One important distinguishing feature is the fact that the red spider is a web-spinning species, whereas the red mite does not possess the faculty of producing the fine silken threads so characteristic of a red spider outbreak. The species may also be separated in the laboratory by the relative lengths of the four pairs of legs in the adults, the front pair of legs in the red mite being much longer than the other pairs, whereas in the red spider such a disparity does not exist.

Life History and Habits.

The round, somewhat transparent, eggs, which cannot be seen without the use of a hand lens, are laid among the silken threads on the under sides of the leaves of selected host plants, each adult female being capable of laying from sixty to seventy eggs at the rate of two to six a day during her adult life of two weeks. These eggs are laid irregularly on the infested foliage, and hatch after an incubation period of four or five days. The mites on hatching are six-legged, colourless and rather transparent, but after feeding they acquire a greenish-yellow tinge. The female mites vary very appreciably in colour, yellow, green and brick-red individuals occurring, the otherwise uniform colour being broken by the presence of two dark spots, one on each side of the body, the occurrence of these spots being responsible for the designation of two-spotted mite which is sometimes applied to this species. The adult female possesses four pairs of legs, a short, rounded body, and mouth parts that enable it to suck the sap of the plant on which it is feeding, the length of the adult being about one-sixtieth of an inch. The adult male is somewhat smaller than the adult female, is less rounded, and is rather salmon-coloured, the darker spots being less conspicuous than in the female. During the height of summer the life cycle is completed in less than a fortnight.

As a result of the feeding of this mite small, pale spots appear on the infested foliage, which thereby acquires a mottled and unhealthy appearance. As the infestation becomes more intense the whole leaf acquires a light, unhealthy colour and withers, reddish-brown blotches not infrequently appearing, premature leaf fall and consequent weakening of the plant being the inevitable outcome of severe infestation. The under surface of infested leaves often has the appearance of having been dusted with a fine white powder, this impression being conveyed by the presence of large numbers of cast skins.

The red spider reaches its maximum abundance during warm, dry weather; heavy rain and a fall in temperature lead to a rapid decline in its numbers.

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* *Tetranychus telarius L.*

Control.

Spraying infested plants with lime sulphur at a strength appropriate to the plant to be treated and to the prevailing weather conditions produces satisfactory results against this pest. Lime sulphur sprays are unsuitable for some of the host plants of the red spider, and in such cases dusting with sulphur is sometimes employed. Reports on the results of sulphur dusting are, however, somewhat conflicting. The control of this pest should be undertaken at an early stage in the infestation, and whether spraying or dusting is employed every effort should be made to cover the under surface of the foliage, which is, of course, the seat of infestation. Furthermore, treatment should be carried out in such a manner as to ensure that no injurious residues occur on the marketed product. Spraying with a strong jet of water is sometimes recommended as suitable for relieving a few sturdy garden plants from red spider attack.

The fact that red spider breeds on quite a number of weeds suggests another line of control, namely, the elimination in so far as is practicable of whatever weeds are known to harbour the pest. Such weeds growing among or in the vicinity of the cultivated plants, or on or near the ground to be planted, are best destroyed by cultivation.

CARE OF SICK ANIMALS.

Stockowners are frequently required to diagnose and treat sick animals and, from their constant observation of stock in good health, are quick to notice any abnormal behaviour due to sickness. A knowledge of the normal temperatures, pulse and respiration rates of various animals is most valuable in arriving at a correct diagnosis of the trouble. The temperature of all young animals is somewhat higher than that of older animals, and various influences—such as periods of oestrum, time of day, external temperature, and so on—may alter the temperature of the mature animal. The temperatures of healthy farm animals are:—horse, 99.5—101 degrees; cow, 100—101 degrees; sheep, 103 degrees; pig, 102.5 degrees.

The temperature of an animal is usually measured in the rectum, and a self-registering thermometer such as is commonly used in human practice may be used. Care should be taken to see that the column of mercury is shaken down. A small quantity of vaseline smeared on the bulb as a lubricant to assist the passage of the instrument is desirable, and it is inserted with a circular motion between the fingers, forward in a line with the backbone, and allowed to remain for a few minutes before it is withdrawn carefully and the reading taken. If the temperature of an animal is found to be about 2.5 degrees above normal it is said to have a low fever, if it reaches the vicinity of 4 degrees above normal a moderate fever is indicated; and, if in the neighbourhood of 6 degrees above normal, it has a high fever.

In some diseases, such as tetanus and sunstroke, the temperature may be as much as 10 degrees above normal. Having decided by use of the thermometer whether the sickness is of a febrile or nonfebrile nature treatment and nursing must be considered.

Good nursing is of the utmost importance. The patient should be provided with a soft bed, shade from sun, wind, or rain, and a rug in cold weather. A supply of water and green feed should also be provided if possible.

Medicines are usually administered by the mouth in the form of a drench, and it is necessary to be careful and patient in the use of this method. The head of the animal should not be raised above a horizontal position, and only small quantities of the drench poured into the mouth at a time, allowing time for swallowing. Pinching the throat to induce swallowing should not be practised, and the head should be lowered if the patient commences to cough.—W. DIXON, Inspector of Stock.

Sown Pastures and their Management.

C. W. WINDERS, B.Sc.Agr., Assistant Agrostologist.

(PART I.)

THE NEED FOR SOWN PASTURES.

ECONOMIC livestock production is dependent upon productive permanent pasture, which is the cheapest form of stock food. Whilst in Queensland much of the native pasture of the open downs, and of the more open types of forest country, has always been of good grazing value, the denser eucalypt forests, the rain forests (or "scrubs"), and the brigalow "scrubs," in their natural state, carry little or no grass and are practically useless for grazing purposes. The rapid conversion of heavily-timbered country into grazing land involves the sowing down of pastures. Since the latter part of the last century the timber of hundreds of thousands of acres of country has been replaced by artificially sown pastures, and the possibilities of expansion in this direction are enormous. The replacement of unproductive native pastures by superior pasture types also calls for artificial seeding.

In another direction, too, there is scope for the sowing down of pastures of a semi-permanent type. Continuous cultivation of cropped lands assuredly causes a very serious depletion of soil fertility, and also produces adverse changes in soil structure. These retrograde changes can best be arrested, and the soil more or less restored to its original condition, by alternating crop production and the grazing of semi-permanent pastures. The beneficial effects of including semi-permanent pasture in a cropping system are intensified if the pasture consists wholly or in part of leguminous plants such as lucerne and clovers.

Yet another function for which sown pastures may and should be more widely utilised is the prevention of soil erosion and soil drift.

Plate 1.

Bull Mitchell grass (*Astrebla squarrosa*) on a mixed Mitchell grass plain in Western Queensland.

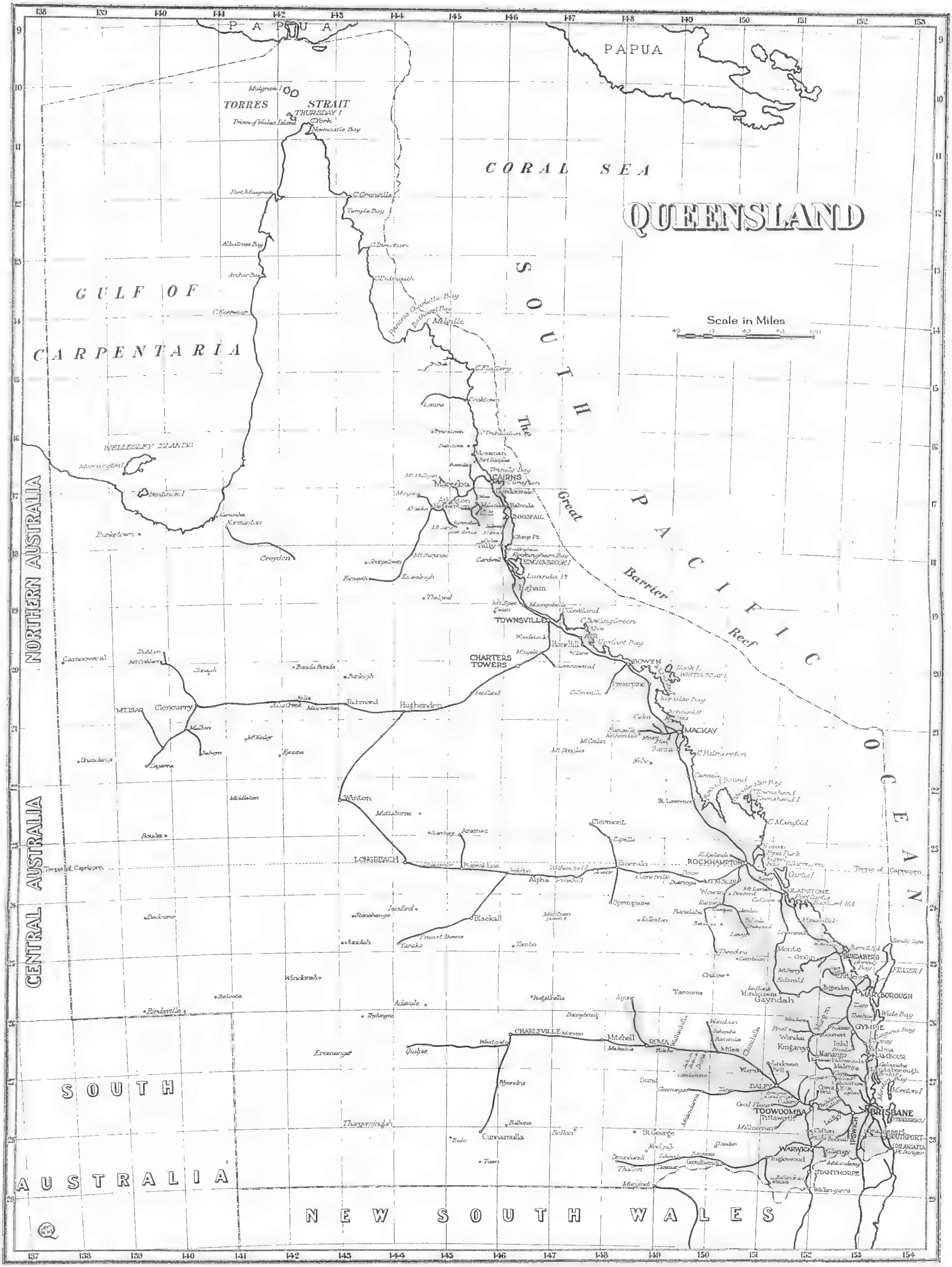
[*Photo., W. D. Francis.*

Plate 2.
Typical grassland forest, South Burnett.

Plate 3.

Brigalow and Belah scrub carrying a heavy coating of native grasses eighteen months after ringbarking.

[*Photo., J. A. Lunn.*



MAP SHOWING THE MAIN AREAS (MARKED IN RED) IN WHICH SOWN PASTURES ARE UTILISED.

In addition to their usefulness in the above respects,—viz., as cheap food for livestock, as a factor in maintaining agricultural soils in good condition, and as a soil conserving agency—sown pastures are valuable for reclaiming certain types of poor lands, for surfacing playing fields, etc., and for a variety of other purposes.

PASTURE TYPES IN QUEENSLAND.

The major pasture areas of Queensland are embraced in the following classification:—

I. Native pastures, consisting for the most part of Mitchell grass and blue grass downs (occupying large areas in Western Queensland) and tropical forest grassland extending from Cape York Peninsula to the southern border of the State. (Plates 1 and 2.)

II. Semi-natural pastures of native species self-established in forest country after clearing, ringbarking, or poisoning of the standing timber has been effected. (Plate 3.)

III. Artificially sown pastures, laid down by landholders.

Native pastures occupy a total area of about 300 million acres in Queensland. Less than one million acres is under artificially sown pastures, and of this total the area carrying permanent winter pastures is but a few hundred acres. The grasses sown for summer grazing purposes are (for the most part) not native to Australia, but are introductions from countries which experience climatic and soil conditions resembling those in parts of Queensland that are devoted to dairying and other semi-intensive grazing industries.

Although they represent only a small proportion of the State's pastures, sown pastures are of considerable importance, particularly to the dairying industry. Most of Queensland's beef cattle and sheep are raised on the immense area of native pastures; but, with the anticipated expansion of the chilled beef and fat lamb export industries, which will demand a continuity of supply of animals in "full bloom," the area under sown pastures is likely to be greatly extended at the expense of native pasture, crops, or forest.

The areas of the State in which unirrigated sown pastures are used are virtually coincident with the areas indicated on the accompanying map (Plate 4) as being devoted to agriculture and dairying, although it is probable that the area could be extended in many directions, particularly in the Maranoa district.

KINDS OF SOWN PASTURES.

In the agricultural districts and areas adjacent thereto the types of sown pastures which can be utilised are as follows:—

I. Permanent and semi-permanent pastures, composed of perennial and/or self-regenerating annual species. They are expected to persist for a number of years, and may be intended either for spring-summer-autumn grazing (e.g., paspalum and Rhodes grass pastures), or for autumn-winter-spring grazing (e.g., Phalaris and Wimmera ryegrass pastures).

II. Temporary pastures of annual species, sown to tide animals over periods of stress in permanent pastures or for soil improvement purposes. Such temporary pastures can be so arranged as to take the place entirely, or nearly so, of permanent sown pastures.

Since there is practically no regularly irrigated pasture in Queensland, the types of sown pasture which succeed in any particular district are determined largely by climatic conditions within that district; but, as the rainfall is everywhere chiefly of summer incidence and the winters not unduly cold, permanent summer-growing pastures predominate and usually suffice to maintain production from late spring until early autumn. The usefulness of permanent winter-growing pastures is strictly limited; first, by the paucity and unreliability of the winter rainfall, and, secondly, by the hot conditions of summer.

Temporary pastures are more commonly used to provide winter and early spring grazing than they are for summer grazing, though, in some predominantly agricultural districts, summer-growing annuals, such as Sudan grass, are largely used as an alternative to permanent pasture.

A large proportion of the artificially sown pastures established in Queensland is found in the coastal areas originally covered by rain-forest. The rain-forest areas correspond with rich basaltic and alluvial soils, and on such soils, in areas with an average rainfall of over 40 inches per annum, such as the Atherton Tableland and those portions of the coastal fringe on which dairying is conducted, a South American native, *Paspalum dilatatum*, finds conditions suitable to its vigorous development. It should be remarked, however, that the hottest and wettest coastal district (i.e., the far north coast) is somewhat unsuitable for paspalum and there grasses such as Para grass (*Brachiaria mutica*) and molasses grass (*Melinis minutiflora*) are the chief cultivated pasture grasses.

In addition to the rain-forests of the coastal areas, there occur in the country lying between the coastal ranges and the crest of the Great Dividing Range, "scrubs" of a drier type. Softwood areas of this nature occur on basaltic soils and on rich alluviums, and in most of the settled districts the original timber has been felled and burnt and the land sown to Rhodes grass (*Chloris gayana*) for grazing by dairy cattle. Rhodes grass and paspalum have also been sown extensively after the clearing of heavily-wooded blackbutt forests lying close to the coast; and, on the cleared sections of the brigalow scrub areas of Queensland, Rhodes grass has been sown with good results.

Whilst the grasses mentioned above, together with lucerne, provide the bulk of the sown pasturage in Queensland, many other plants are of value in special situations and for special purposes. A number of these are described in a later section.

ESTABLISHMENT OF PASTURES.

Seed Quality.

When purchasing seeds of any description, farmers and graziers should satisfy themselves that their purchases at least reach the standard prescribed in the regulations under the Queensland Pure Seeds Acts, which are administered by the officer in charge, Brisbane seed testing station, Department of Agriculture and Stock.

The following sets out the absolute minimum percentage of germination in good seed:—

Kind of Seed.	Minimum Germination. Per Cent.	Kind of Seed.	Minimum Germination, Per Cent.
Grasses—		Millets, &c.—	
Cocksfoot	60	Japanese millet	75
Couch grass	40	*Setaria italica* (panicum) ..	75
Giant panic grass (blue panic)	40	White panicum	75
Italian ryegrass	65		
Molasses grass	20	Cereals—	
Paspalum	30	Barley	80
Perennial ryegrass	60	Maize	80
Phalaris	55	Oats	80
Prairie grass..	65	Rye	80
Rhodes grass	30	Wheat	80
Wimmera ryegrass ..	65		
Clovers, &c.—		Miscellaneous—	
Alsike clover	75	Seed canary grass ..	65
Berseem clover ..	65	Cowpea	70
Black medic	70	Field pea	75
Burr medic	60	Peanut	60
Clustered clover	40	Rape	70
Lucerne	75	Sheeps Burnet	60
Red clover	75	Sorghum	70
Subterranean clover ..	70	Sudan grass	65
Townsville lucerne	40	Tares, vetches	60
White clover	70	Velvet bean	60

Not more than 2 per cent. of inert matter (i.e.), broken seed less in size than one-half of a complete seed, or chaff, dust, stones, or any material other than seeds, should be present in any seeds except in the following cases:—

Kind of Seed.	Maximum Inert Matter, Per Cent.
Cocksfoot	3
Paspalum	4
Prairie	5
Rhodes grass	6

A maximum of 1 per cent. of weed seeds, or seeds of any kind other than the kind under consideration, is allowable.

The presence of the following seeds is totally prohibited:—

Dodder, datura (thorn apple), castor oil, and diseased or insect infested seeds.

The prohibited seed list and proportion of weed seeds allowed are at present under revision; when available these lists will be found to be much more stringent than is set out above.

The Department of Agriculture and Stock carries out free examination of samples of seed purchased by farmers for their own use, and if a farmer is not satisfied that the purity and germination of seed bought by him are up to the standard, he should at once send a sample to the

Head Office of the Department in Brisbane. The particulars which should be set out in ink on the package containing the sample are as follows:—

(*a*) Name under which seed was purchased;
(*b*) The number of bags from which the sample was drawn, and the number of bags in the consignment;
(*c*) The marks of identification, if any, on such bags;
(*d*) The name and address of the sender, with date of sampling: and
(*e*) The name and address of the sender's supplier, with date of delivery.

The samples should be addressed as follows:—

Seed Sample for Examination.

The Officer in Charge,
Seed Testing Station,
Department of Agriculture and Stock,
BRISBANE, B.7.

When sending samples, it is of the utmost importance that they be drawn by the sender from seeds in his actual possession, care being taken to make them truly representative of the bulk.

To enable this to be done satisfactorily they should be drawn alternatively from the top, middle, and bottom of the bags, the proportion of bags to be sampled being as follows:—

1 to 19 bag lots—A portion from each bag.
20 to 39 bag lots—A portion from not less than 20 bags.
40 to 59 bag lots—A portion from not less than 28 bags.
60 to 79 bag lots—A portion from not less than 32 bags.
80 to 99 bag lots—A portion from not less than 36 bags.
100 to 199 bag lots—A portion from not less than 40 bags.
200 bags and over—A portion from not less than 20 per cent.

If, when drawing samples, it is observed that great variation occurs in the bulk, two or more samples should be obtained, each representing bags whose contents are similar.

After the sample has been drawn as above indicated it should be emptied out on to a large piece of paper, thoroughly mixed, and then a quantity not less than the prescribed weight for such samples should be drawn for purposes of forwarding to the seed laboratory. A duplicate sample should be kept for reference.

In the seed testing station, great pains are taken to ensure absolute accuracy of work. It therefore follows that all this care is wasted unless the person forwarding samples for examination takes some trouble to ensure that the samples drawn truly represent the bulks from which they are obtained. The minimum weight of such samples is as follows:—

8 oz. for large seeds such as beans, cereals, etc.
4 oz. for lucerne, millet, sudan and such like seeds.
3 oz. for grass seeds.

In the case of seeds not mentioned above, the weight set out for the seed of nearest size, should be forwarded.

In the case of seeds obviously containing weed seeds or other foreign ingredients, not less than double weight mentioned should be sent.

Farmers and others, who grow seed for their own use or for sale purposes, should have some knowledge of what factors are responsible for variations in the agricultural value of seeds.

Immaturity of seed is a common cause of poor establishment in the field, and often is due to harvesting too early. Uneven ripening of seed, as well as a desire to harvest before any of the dead-ripe seed shatters, are responsible for the harvesting of much unripe seed. Some seeds, even though harvested when apparently ripe, require a resting or maturing period after harvesting and prior to sowing. Paspalum seed, for instance, germinates poorly if sown directly after harvesting: but if stored for some months its germinability is markedly increased. The storage period for any seeds cannot, however, be prolonged indefinitely. Under suitable conditions a small percentage of wheat seeds may retain its viability for about thirty years, but most seeds lose their germinability at a much younger age. The following figures have been supplied by F. B. Coleman, officer in charge, Brisbane seed testing station, and relate only to seed stored under the very best conditions available in Brisbane (i.e., in a brick building, airy, free from insects and from rapid changes in temperature). In all cases the seed was properly dry and free from decay. Any departure from these ideal storage conditions will result in greater loss of germination than is shown below. Humid conditions and/or prolonged lack of fresh air are particularly conducive to loss of viability.

Kind of Seed.	Age of Seed.			
	1 Year. Germination Per Cent.	2 Years. Germination Per Cent.	3 Years. Germination Per Cent.	4 Years. Germination Per Cent.
Paspalum dilatatum	55	62	45	12
Prairie grass	70	60	Nil	Nil
Rhodes grass	50	40	26	15
Millets—				
Giant and dwarf setaria (giant panicum) (Hungarian millet)	88	76	56	20
Japanese millet	97	95	84	58
White panicum	91	81	74	65
Lucerne	91	80	59	50
Sorghum	91	85	69	47
Sudan (*Sorghum Sudanensis*) ..	94	90	82	59

Insect pests, such as weevils, often destroy large quantities of seeds and should be exterminated by fumigation. Unsound seed is to be avoided. Seeds which are cracked, chipped, or broken are very likely to have their embryos damaged, and even if the seed is capable of germinating, any breaks in its surface will admit fungi and so tend to lower the germination capacity.

The seeds of many legumes, including clovers, are peculiar in that a proportion has extremely hard and impermeable seed-coats, which delay germination for some considerable time. Under natural conditions

this delayed germination of portion of the seed shed may be of considerable advantage; but under cultivated conditions a ready germination is almost always desirable. For this reason seeds of certain legumes are often scarified by scratching the surface with sandpaper, etc., or are treated with certain chemicals. Any treatment which increases the permeability of the seed-coat without injury to the seed itself permits of the quicker germination of hard seeds.

Certain pasture plant seeds carry the tiny fruits of disease-causing fungi. Much of the paspalum seed harvested since 1935 has been infested with spores (or fruits) of the fungus causing ergot. When this seed is sown the fungus is introduced to the area and, given favourable conditions, will develop and attack the seedheads of the new plants. Paspalum seed, containing visible "ergots" as a contamination, should not be used for sowing. Another grass which carries a disease in the seed is prairie grass. The disease referred to is smut and when it attacks a plant of prairie grass much or all of the seed may be rendered useless. The fruits of the smut fungus may be destroyed by treating the healthy seed with a disinfectant, as will be explained in a later section.

The Value of "Strain" in Pasture Plants.

When considering the purchase of seeds for pasturage one usually has the choice of several lots of seed of the same kind with varying prices. A solution of the problem is easily obtained by consideration of the fact that when purchasing animals one would ask for the pedigree. Seeds are life and the buying of good seeds with a pedigree is a sound proposition.

Many pasture plants are now grown in countries far removed from their original homes. Rhodes grass, for example, is a native of Africa which, within the past half century has been distributed to all other continents. It is only to be expected that in course of time the type developed in any particular area should differ in some respects from the types developed under different conditions of climate, soil, or management. In the case of Rhodes grass, for instance, lines raised from certain Queensland-grown seed are leafier than most African lines of the grass. Even at present a limited export trade in Rhodes grass is enjoyed by Queensland. Different types may, of course, develop within a small country, e.g., the perennial ryegrass grown in the Hawkes Bay district of the North Island of New Zealand is quite different from the perennial ryegrass grown in the Canterbury district of the South Island. The different types which occur within a species are known as "strains."

In countries in which pasture research is highly developed (e.g., New Zealand and Great Britain) commercial and other lines of seed of the locally most important grasses and clovers have been collected from many local and foreign sources and the best strains separated out by field trials. The seed-producing areas growing superior strains are in many instances permitted to be registered with the Department of Agriculture concerned and a certificate relating to the origin of the seed is issued. Thus we have on the market New Zealand Government certified perennial ryegrass and white clover seeds, New South Wales Government certified *Phalaris tuberosa* seed, etc. By purchasing certified seeds, the farmer is assured of obtaining seed harvested from areas which have been shown to the satisfaction of responsible authorities to be constituted of desirable pasture types.

A certain amount of work on the testing of strains of pasture plants has been, and is being, carried out in Queensland. The present position is summarised in the following table:—

Species.	Chief Seed Lines and Origin.	Remarks.
Rhodes grass	*Queensland grown	Strain work in progress
Couch grass	*New South Wales grown	..
Molasses grass	*Queensland grown	..
Giant panic grass (blue panic grass)	*Queensland grown	..
Paspalum	*Queensland grown	Ergot-free seed desirable
	*New South Wales grown	
Prairie grass	*Queensland grown	..
Cocksfoot	*New Zealand Government certified Akaroa	Strain work in progress
	Victorian	
	European	
Perennial ryegrass	*New Zealand Government certified permanent pasture	
	*New Zealand Government certified mother seed	
	*Victorian Government certified	
	New Zealand, Victorian, and New South Wales, uncertified	
Wimmera ryegrass	*New South Wales grown	
	*Victorian grown	
Phalaris	*New South Wales Government certified	
	New South Wales uncertified	
Millets and "Panicums"	*Queensland grown	
	*New South Wales grown	
Sudan grass	*Queensland grown	Strain work in progress
	*New South Wales grown	
Sorghums	*Queensland grown	
	*New South Wales grown	
Oats	*Southern States	
Barley	*Queensland grown	
	*New South Wales grown	
Italian ryegrass	*New Zealand Government certified	
	*New Zealand uncertified	
Seed canary grass	* Queensland grown	
Rye	*New South Wales grown	
Wheat	*Queensland grown	
	*New South Wales grown	
Lucerne	*New South Wales grown	
Sheeps Burnet	*Imported	
Townsville lucerne	*Queensland grown	
Burr medic	*Southern States	
Black medic	*Southern States	
Clustered clover	*Southern States	
Alsike clover	*Canadian grown	
Red clover	*New Zealand grown	
White clover	*New Zealand Government certified	
	New Zealand ordinary	
	European	
Subterranean clover	*Various Governments certified strains	
Peanut	*Queensland grown	
Velvet bean (including Mauritius bean)	*Fiji, New Guinea, and Papua	
Cowpea	*Queensland grown	
Rape	*Imported	
Field pea	*Southern States	
Berseem clover	*Imported	

* Recommended for use in Queensland in preference to other lines of seed of the same species.

[TO BE CONTINUED.]

A Top-dressing Experiment on the Pastures of the Sandy Ridges of the Lockyer Valley.

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Introduction.

THE Lockyer Valley, in common with much of the West Moreton district, consists of black soil flats interspersed with sandstone ridges of the Walloon series. The flats are, for the most part, cultivated, while the ridges, which have been partly cleared, are used for the pasturing of cattle. The soils on these sandstone ridges are generally poor and shallow, podzolic in character, and carry a rather open stand of low fertility demanding plants, Bitter Blue or Pitted Blue grass (*Bothriochloa decipiens*) being the dominant grass. The carrying capacity of these pastures is low, a beast to 10 acres being a fair average.

In an attempt to improve the value of these pastures, a top-dressing experiment was laid out on a section of typical grassland at the Queensland Agricultural High School and College at the end of 1928. The purpose of the experiment was to study the increase in bulk and quality of the existing pasture plants, the encouragement of higher fertility demanding plants, and the stimulation of legumes, of which a few native species were known to occur.

The area selected (Macarthur 6 paddock) was a ridge with a fairly uniform southerly aspect, which was cleared of the original timber (mostly Ironbark—*Eucalyptus crebra*) in 1901 but not entirely stumped, and cleared of a second growth of ironbark in 1924-25, since when it has been used for grazing and burnt off approximately every two years—a fairly general local practice. The average annual rainfall is 28·6 inches with a decided summer maximum, approximately 17 inches falling within the period November to March, inclusive. The rainfall during the period of the experiment was a fair average, as shown by the following table:—

	1928. Points.	1929. Points.	1930. Points.
January	—	224	599
February	—	598	356
March	—	415	130
April	—	437	—
May	—	7	—
June	—	147	—
July	—	65	—
August	—	102	—
September	—	19	—
October	139	273	—
November	177	152	—
December	352	239	—

Treatments.

The fertilizers used were sulphate of ammonia, superphosphate (20·5 water soluble P_2O_5), and basic superphosphate, both singly and in some combinations. Basic superphosphate as a regular dressing was suggested

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on account of the somewhat acid nature of the soil. The fertilizers were applied as uniformly as possible with a standard type of fertilizer spreader.

Nineteen plots, each of approximately 1 acre, were laid out, systematically in a single range, each treatment being replicated once. Fertilizer applications were made in October, 1928 (after a burn) and December, 1929,—i.e., at the beginning of the rainy season, as follows:—

Plot No.	Treatment.	Applications in Cwt.		Total Application.
		October, 1928.	December, 1929.	
1	C	..	..	..
2	N	1N	1N	2N
3	2P + N	2P + 1N	2P + 1N	4P + 2N
4	C	..	..	..
5	P + N	1P + 1N	1P + 1N	2P + 2N
6	P	1P	1P	2P
7	C	..	..	..
8	7P	2P	5P	7P
9	BP	2BP	2BP	4BP
10	C	..	..	..
11	N	1N	1N	2N
12	2P + N	2P + 1N	2P + 1N	4P + 2N
13	C	..	..	..
14	P + N	1P + 1N	1P + 1N	2P + 2N
15	P	1P	1P	2P
16	C	..	..	..
17	7P	2P	5P	7P
18	BP	2BP	2BP	4BP
19	C	..	..	..

C = Control (no manure).
N = Sulphate of ammonia.
P = Superphosphate.
BP = Basic superphosphate.
Numbers represent cwts. per acre.

Early in 1930 it was noticed that the plots treated with sulphate of ammonia showed a better colour and a greater bulk of material than plots whose treatment had not included nitrogen. It was decided, therefore, to make a botanical analysis over the whole area in order to obtain an accurate picture of the developments that were taking place. This analysis was begun in February, 1930, and continued in March.

Sampling Method.

The method used was that of estimated percentage area. On each plot fifty throws of a mesh 2 links by 2 links, divided into 4, were made. The throws were made at random about points systematically arranged so that the whole of each plot was sampled. One throw was made on each plot in turn so that the effect of the time taken to complete the analysis might be overcome—a single series of throws was completed each half day. In each throw the total ground cover and cover of each species were estimated and the herbage then cut about an inch from the ground, this material being used to obtain weights and chemical composition.

Botanical Composition.[4]

The pasture is of complex type, fifty species having been recorded, though only twelve species occur with frequencies greater than 1 per cent. The average composition of the pasture was as follows:—

(4) The original determination of species was done by Mr. C. T. White, F.L.S., Government Botanist, who visited the College for the purpose on several occasions.

Average Botanical Composition of Sandy Ridge Pasture at Gatton College.

	Per cent.
Percentage Cover	53.8
Fimbristylis diphylla	22.24
Bothriochloa decipiens	20.32
Eragrostis elongata	10.09
Eremochloa bimaculata	10.08
Brachiaria distachya (?)	6.88
Aristida spp.	5.25
Heteropogon contortus	4.73
Eragrostis leptostachya	3.74
Sporobolus elongatus	2.53
Cyperus spp.	1.56
Panicum effusum	1.24
Tripogon loliiformis	1.17
Eragrostis parviflora	0.97
Sida subspicata	0.87
Cynodon dactylon	0.87
Portulaca sp.	0.85
Cheilanthes tenuifolia	0.79
Epaltes australis	0.72
Jasminum suavissimum	0.66
Glycine tabacina	0.57
Digitaria divaricatissima	0.55

Traces of the following:—

Lagenophera solenogyne
Chloris truncata
Chloris divaricata
Chloris gayana
Chloris acicularis
Bothriochloa intermedia
Cymbopogon refractus
Paspalidium jubiflorum
Digitaria Brownei
Paspalum distichum
Themeda australis
Eriochloa punctata; Helichrysum apiculatum; Myoporum debile; Wahlenbergia gracilis.
Zornia diphylla
Cassia mimosoides
Indigofera baileyi
Evolvulus alsinoides
Boerhaavia diffusa
Calotis lappulacea
Tragus racemosus
Phyllanthus multiflorus
Glossogyne tenuifolia; Justicia procumbens; Aneilema gramineum; Portulaca oleracea; Rumex brownii; Eleusine indica.

(Results obtained from botanical analyses of 950 samples.)

For a more critical study of the pasture, the species were grouped as follows:—(1) Better type grasses; (2) Poor grasses; (3) Legumes; (4) Miscellaneous Herbage Plants; (5) Weeds; and (6) Cyperaceæ, the last group being formed on account of *Fimbristylis diphylla*. The components of the various groups are—

(1)

Eragrostis elongata
Eremochloa bimaculata
Brachiaria distachya (?)
Eragrostis leptostachya
Panicum effusum
Tripogon loliiformis
Eragrostis parviflora
Cynodon dactylon
Digitaria divaricatissima
Bothriochloa intermedia
Chloris acicularis
Chloris divaricata
Chloris gayana
Chloris truncata
Digitaria Brownei
Eleusine indica
Eriochloa punctata
Paspalidium jubiflorum
Paspalum distichum
Themeda australis

(2)

Bothriochloa decipiens
Aristida spp.
Heteropogon contortus
Sporobolus elongatus
Tragus racemosus
Cymbopogon refractus

(3)

Glycine tabacina
Cassia mimosoides
Indigofera baileyi
Zornia diphylla

(4)

Boerhaavia diffusa
Calotis lappulacea
Helichrysum apiculatum
Portulaca oleracea

(5)

Sida subspicata
Portulaca filifolia
Cheilanthes tenuifolia
Jasminum suavissimum
Aneilema gramineum
Evolvulus alsinoides
Epaltes australis
Glossogyne tenuifolia
Justicia procumbens
Lagenophora solenogyne
Myoporum debile
Phyllanthus multiflorus
Rumex brownii
Wahlenbegia gracilis

(6)

Fimbristylis diphylla
Cyperus spp.

The average botanical composition and percentage cover for the various treatments were then found to be—

Treatment.	Percentage Ground Cover.						
	Total.	Group Number.					
		(1)	(2)	(3)	(4)	(5)	(6)
N ..	Observed 58·57 Calculated 48·58	41·56 35·11	27·39 37·46	1·49 1·22	1·91 1·58	2·21 4·48	23·97 20·46
N + P ..	Observed 54·7 Calculated 52·5	34·07 34·06	34·42 37·25	0·47 0·89	0·87 0·47	2·5 3·73	26·54 22·91
N + 2P	Observed 54·37 Calculated 49·69	33·73 31·87	35·65 39·03	1·02 1·08	0·7 0·97	5·06 4·62	23·0 21·41
P ..	Observed 53·37 Calculated 54·2	29·61 37·83	36·72 33·9	0·94 0·83	0·45 0·6	12·96 2·71	27·69 23·73
7P ..	Observed 51·77 Calculated 55·83	41·84 42·99	25·84 29·15	0·79 0·93	0·47 1·07	2·70 2·19	23·29 22·53
BP ..	Observed 55·42 Calculated 55·76	40·87 44·38	26·61 27·75	0·87 1·08	1·37 1·42	3·52 2·67	25·02 21·04
Control ..	52·26	37·24	34·38	0·99	1·06	3·09	21·86

(Calculated percentages were obtained in each case by taking the percentage of the two nearest control plots and using the formula—

$$\text{Calculated percentage Plot } 1 = \frac{2C_1 + C_2}{3} \text{ where the order of plots is } C_1.\ 1.\ 2.\ C_2.)$$

It will be seen that fluctuations of some size occur between the various treatments, but that these are more or less in accordance with the variations in the nearby controls, as instanced by the calculated figures. In no case does there appear to be any significant change in botanical composition as the result of treatment. The time factor, no doubt, is partly responsible for this result, and a further botanical analysis of the area after the lapse of several years might show a different result.

The low percentage of legumes present is a notable feature of the survey. The use of phosphate had failed to stimulate their development up till the cessation of the analyses.

Yields.

The material cut within each mesh throw was weighed to the nearest ½ gram on the plot (green weight). Each sample was then placed in a paper bag well ventilated with holes and hung in a dry shed for approximately a fortnight. The sample was then weighed (air-dried weight), heated in a hot-air oven at 110 degrees C. for two hours, and again weighed when cool (oven-dried weight).

Chemical Composition.

The samples from each plot, after oven drying, were chaffed, thoroughly mixed, and a representative sample taken and analysed for

nitrogen and phosphates, the methods of analysis being those given in "Methods of Analysis of the Association of Official Agricultural Chemists" (Washington, 1925), 19, p. 7, and 7, p. 3, respectively. All analyses were duplicated.

Results.

Plot and Treatment.	No. of throws.	Average weight per throw (grms.).			*N per acre (lbs.)	*P_2O_5 per acre (lbs.)
		Green weight.	Air dried weight.	Oven dried weight.		
1·C ..	47	68·862	30·654	27·702	1138	513
2·N ..	47	125·489 (74·001)	51·976 (34·19)	47·002 (30·977)	1841 (1211)	489 (521)
3·2P + N	47	117·468 (79·141)	53·014 (37·726)	48·285 (34·252)	1896 (1283)	823 (529)
4·C ..	50	84·280	41·262	37·527	1356	537
5·P + N	50	116·920 (83·637)	55·928 (40·077)	50·737 (36·381)	1978 (1328)	921 (577)
6·P ..	50	95·120 (82·993)	43·856 (38·893)	39·697 (35·234)	1568 (1301)	895 (617)
7·C ..	50	82·350	37·708	34·088	1273	656
8·7P ..	50	70·730 (77·877)	31·793 (34·499)	28·589 (31·142)	1175 (1182)	755 (595)
9·BP ..	50	71·540 (73·403)	31·763 (31·290)	29·169 (28·197)	1239 (1091)	609 (534)
10·C ..	50	68·930	28·081	25·251	1000	472
11·N ..	50	99·950 (74·893)	44·021 (30·724)	39·806 (27·667)	1583 (1104)	701 (518)
12·2P + N	50	116·720 (80·937)	46·525 (33·368)	42·089 (30·084)	1924 (1207)	949 (563)
13·C ..	50	86·820	36·011	32·500	1312	608
14·P + N	50	130·440 (82·693)	49·355 (34·003)	44·204 (30·656)	1661 (1402)	692 (569)
15·P ..	50	84·610 (78·187)	34·264 (31·094)	30·869 (28·813)	1287 (1494)	560 (530)
16·C ..	50	73·930	29·986	26·969	1585	490
17·7P ..	50	77·890 (72·513)	31·233 (29·285)	28·047 (26·357)	1109 (1446)	460 (501)
18·BP ..	50	67·220 (71·177)	26·857 (28·583)	23·979 (25·745)	1120 (1307)	567 (513)
19·C ..	50	69·800	27·882	25·133	1168	525

(* Lb. per acre = oven dried weight in grams per throw × % × 55.)
Calculated figures are shown in brackets after recorded amounts.

These results were analysed according to "Student's" method, and significant differences compared with check were found to be as follows:—

Treatment.	Difference Between Treatment and Check in				
	Green Weight.	Air Dried Weight.	Oven Dried Weight.	N. per acre.	P_2O_5 per acre.
N only	None	None	None	None	None
P only	None	None	None	None	None
P + N only	47·1%	41·1%	41·1%	42·9%	51·25%
BP only	None	None	None	None	None
All plots with P and BP ..	21·1%	19·1%	19·2%	None	30·8%
All plots with N	57·8%	43·2%	43·2%	44·4%	39·6%
P and BP only	None	None	7·7%	None	None

It will be noticed that the only significant differences were obtained from N + P combinations, the significant differences observed under the headings "All plots with P and BP" and "All plots with N" being due to the effect of the P + N plots which were included therein. The N + P plots showed significant increases in gross yield, in nitrogen yield, and in phosphate yield.

It is also to be noted that, with the exception of the "P and BP only" combination, there was no difference between air-dried and oven-dried weights, in so far as significances are concerned. For such pasture air-drying, even in the humid conditions of late summer, appears to be sufficient. Green weights give an indication of trends in such a mixed pasture, but differences in this case tend to be exaggerated.

As the increased yields of nitrogen and phosphorus over the two months of sampling are only of the order of the increase in total bulk, it is apparent that in a native pasture of this type there was, for the period in question, no increased assimilation of either nutrient. The pasture was more bulky but no richer as the result of the top-dressing. This result agrees with the suggestion made verbally by Professor A. E. V. Richardson to the authors—that our native species, having been developed under conditions of low nitrogen and low phosphates, are unable to make full use of additional supplies of these materials.

Economic Aspect.

An increase in yield of approximately 40 per cent. resulted during the months of February and March from the use of nitrogen and phosphate in combination. No other determinations were made. The carrying capacity of untreated land is generally considered to be one beast to 10 acres. The increased carrying capacity might thus be four beasts per 100 acres. If the value of a bullock be taken at a figure of £8, and 25 per cent. of the stock can be marketed each year, the increased return for these two months of maximum growth would be £8 per 100 acres per annum.

Against this must be set the cost of top-dressing. With fertilizer prices at, say, sulphate of ammonia 14s. per cwt., and superphosphate 5s. per cwt., and allowing 1s. 6d. per acre for costs of application (the standard fertilizer spreader used will cover 12 acres per day), the cost of top-dressing amounts to £1 0s. 6d. per acre (1P + 1N), which is £102 10s. per 100 acres. Making all allowances, this figure is greatly in excess of the pasture increment.

Even granting that smaller applications of manures might present a more favourable aspect, and allowing for residual effects over a period of a few years, the application of the tested fertilizers to such pastures is not economic.

Summary.

A poor natural mixed pasture on the sandy ridge country of the Lockyer Valley was top-dressed with a series of artificial manures. The experimental area was botanically analysed by the estimated percentage area method, and cuttings taken to estimate total yield and yield of nitrogen and phosphate.

The only treatment to give an increase was nitrogen and phosphate in combination. This increase was of the order of 40 per cent. in the yield taken over two summer months. There was no increase in percentage of nitrogen or phosphates.

No change in botanical composition was noticeable as the result of top-dressing.

It would appear that top-dressing of such a pasture, of low carrying capacity, is not an economic procedure.

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Plant Nutrition.

E. H. GURNEY, A.A.C.I., Agricultural Chemist.

PLANTS resemble animal life in that they require food for their growth, and the food should be provided not only in sufficient quantity, but in a suitably balanced form. In reviewing plant nutrition, other factors besides plant food have to be taken into consideration. Suitable environment, which includes both soil and climatic conditions, is a most important factor in influencing the growth, successful or otherwise, of any particular plant species.

About fourteen elements are commonly present in plants, and from these elements, with the aid of sunlight, green plants have the power of building their very complex structure. Plants obtain certain of their food requirements from the soil, and the general assumption has been that most soils contain the various plant food materials, though some soils may be insufficiently supplied with nitrogen, lime, potash, and phosphoric acid. Later investigation, however, has made it plain that a deficiency in some of the chemical elements existing in the soil, may cause poor and diseased plant growth.

Plant food is present in the soil in two forms which are respectively available to plants or unavailable. As a result of experiment and research, methods have been discovered by which the amount of available plant food in the soil may be improved or maintained. By cultivation different soil granules are exposed to the weathering action of the air which converts some unavailable into available plant food. The ploughing in of farmyard manure, green-manure crops and waste crop vegetable matter, all increase the humus content of the soil. The humus, during decomposition, yields acids which convert insoluble plant food into a soluble form, capable of being taken up in the soil moisture, and a considerable amount of plant food contained in the organic substance referred to is returned to the soil. Lime, when applied to the soil, besides neutralising soil acidity, is also capable of converting some insoluble soil plant food ingredients to an available form. These methods of soil treatment tend to an improvement of tilth, and good soil tilth is of great value in providing plants with the most suitable condition for obtaining nutriment. It permits of the free entrance and circulation throughout the soil of both air and water and also of easy penetration of plant roots through the soil. These conditions do not prevail in a hard, compact, poorly cultivated soil, in which plants are unable to make the best use of the available plant food.

In the past it has been considered that the majority of soils contain sufficient for plant requirements, with the exception of nitrogen, phosphorus, potassium, and calcium, and that the soil supply of these four elements may require in some cases supplementing by the addition of manures and fertilisers to produce successful crops.

Later investigations in connection with plant growth show that an insufficient supply of some of the less prevalent elements in the soil, or the failure of plants in assimilating such elements, is sometimes the cause of unsuccessful crops, or the cause of disease in plants.

A few remarks may be made regarding the plant nutrients—nitrogen, phosphoric acid, and potash. In connection with nitrogen it is considered that plants generally take up their nitrogen requirements in

the form of nitrate. Nitrogen increases the growth of plant and foliage, and deepens the green colour of the leaves. It also increases the size of the leaves. The pale yellowish tinge that occurs sometimes in green foliage may be caused through an insufficient supply of nitrogen to the plant, though this yellow tinge may be caused by other deficiencies. Plant leaves in sunlight have the power of fixing the carbon dioxide of the air and converting it into sugar which, being soluble, is circulated to different parts of the plant in the plant sap. Excessive supplies of nitrogen will cause an excessive succulence of growth rendering the plant less resistant to disease.

The fertilisers used for supplying nitrogen in Queensland are:—nitrate of soda, which is very quick-acting (the nitrogen being in the form of nitrate); sulphate of ammonia, which also is quick-acting; and blood manure which is fairly quick-acting, as its nitrogen is soon converted into the nitrate form in the soil. The nitrogen in bonedust and meatworks fertiliser is slow acting, as decomposition of the bone in the soil has to take place before the nitrogen is in an available form for plants.

Phosphoric acid as a plant food ingredient influences the production of seed, stimulates root growth and generally hastens the maturity of crops. A number of Queensland's soil types are insufficiently supplied with phosphoric acid; and, on such soils, good results have been obtained from the application of phosphate fertilisers. Superphosphate supplies phosphoric acid in a water soluble form and is therefore quick-acting. As bonedust has first to be decomposed, its phosphoric acid does not become available so readily to plants. Nauru phosphate is also a slow-acting fertiliser, and the effects from its application are more noticeable in the year after application.

In regard to potash, this plant food ingredient influences the production of carbohydrates, and the pulp of fruit and woody structure of plants. Potash is essential for the leaves of plants as it is required in the leaf process, mentioned before, of the conversion of carbonic acid into a carbohydrate, and also for the translocation of this carbohydrate throughout the plant. The potash fertilisers commonly used in Queensland are sulphate and muriate of potash, both of which are quick-acting fertilisers. Wood ashes also contain various amounts of potash, but coal ashes contain practically none.

The necessity for having a balanced supply of the food ingredients mentioned, may be explained, as follows:—A large supply of nitrogen causes excessive and a very succulent foliage growth with low disease resistance. Potash influences the production of carbohydrates and woody substances, and for that reason potash will counteract the effect of too much nitrogen. Potatoes may be mentioned as a crop which noticeably shows ill results through an application of unbalanced fertilisers; for, if a fertiliser with high nitrogen content and somewhat low potash content is applied to this crop, it will cause excessive leaf growth, but there will be insufficient potash throughout the leaves to influence the production of enough carbohydrates for the growth of satisfactory tubers. It will be seen then, that, with the application of a large amount of nitrogenous fertiliser, it will be advisable also to apply an ample amount of potash fertiliser.

Lime (containing the element calcium) though liable to be washed out of the surface to a considerable extent, is present in most soils in

sufficient quantities to meet the actual food requirement of plants. Lime is applied to the land more for the purpose of reducing soil acidity, and the obtaining of good soil tilth, than for plant food. In addition it must be mentioned that some crops such as lucerne and cabbage, require the presence of ample lime in the soil, whereas maize and sorghum will flourish on soils of a more acid nature.

Plant food material applied in fertilisers is rendered more available, if farmyard manure is applied at the same time as the fertilisers, even though the farmyard manure may be available in only a relatively small amount.

Investigations respecting the plant requirements of elements other than those previously mentioned have shown that a deficiency of some elements, even though they may only be required by plants in mere traces, causes poor plant growth and plant disease.

Chlorosis, that is the abnormal yellowing of the plants' green leaf, may be caused through the deficiency of certain plant nutrients. Iron is necessary for the formation of the green colouring matter (chlorophyll) of the leaf, and a deficiency of this element will cause chlorosis. There may be an abundance of iron in the soil, but if the soil has a high lime or manganese content, the assimilation of the iron by the plant will be prevented. This form of deficiency has been remedied in many cases by spraying with iron sulphate, or by applying the iron sulphate to the soil. It has been reported that in some cases, the spraying with iron sulphate and the application of iron sulphate to the soil, did not improve the condition of chlorotic apple trees; but that the injection of iron salts into the trunk of the tree was beneficial. The driving of iron nails into the trunks has also produced effective, though slower, results.

Copper is another element that may have considerable effect in maintaining healthy plant growth. In an investigation in connection with a type of chlorosis and "die-back" of fruit trees, it was found that the trouble was not remedied by the application of potash, iron, manganese, magnesium or sulphur; but that the application of copper sulphate to the soil surrounding the affected trees, at the rate of $\frac{1}{4}$ to 2 lb. per tree, restored the trees to a normal condition.

That plants require for their most successful growth some of what may be termed the less abundant elements is recognised, and the element boron has been applied to some crops with favourable results. Zinc also has been reported as having been successful in controlling chlorosis of some plants.

The action in plant growth of these less abundant elements has been designated by such terms as "catalytic" or "complementary"; but it has to be stated that the elements boron and zinc, in any slight excess, have a very deleterious effect upon plants.

There are elements required by plants which in some soils, may exist in ample quantities, whilst other soils may be supplied only poorly with them. There are some plants, too, which require more than others of a particular element; and in this connection, magnesium and manganese, may be mentioned.

Magnesium is generally present in the soil in sufficient quantity for plant requirements; nevertheless, there are occasions when the application of magnesium salts have proved beneficial to crops. Thus

magnesium is applied in some fertilisers for tobacco. In some citrus orchards in New South Wales chlorosis is considered as possibly due to magnesium deficiency.

Manganese also is usually present in sufficient quantity in the soil; and, in some cases, in such quantity as to prevent the assimilation of iron by plants. But, in some countries, experiments with the application of manganese salts has improved the quality of citrus fruit; and, in some of the experiments, has reduced chlorosis among the citrus trees.

VENT PICKING BY POULTRY.

Every year numerous pullets are lost as a result of vent picking, an acquired vice, which is easily checked when correct control measures are adopted in the early stages. If neglected or overlooked until it is firmly established, control is much more difficult. This vice is confined chiefly to pullets and starts shortly after they commence laying. At times outbreaks will occur among older hens, but in these it is usually less extensive.

Vent picking starts as the result of one bird picking the vent of another bird when it is expelling an egg. The picking causes bleeding and frequently protrusion of the oviduct follows. Once the birds acquire the taste of blood, they are ever on the alert for victims. The pecked bird may be able to get away from the attacker, but in all probability egg laying will keep the wound open and it often becomes septic, resulting in a whitish watery discharge from the vent. Eggs laid by the injured bird will frequently be smeared with blood.

Treating seriously injured birds is of little value, because they seldom make a complete recovery. If considered advisable, however, the injured parts of birds that have been pecked may be painted with Stockholm tar twice daily.

All nest boxes should be darkened by hanging bag curtains in the front of the openings. These curtains encourage the birds to lay in the nests, and, to some extent, reduce the liability to pecking.

As pecking is usually the outcome of idleness, a handful of small grain should be scattered twice daily in the litter on the floor to keep the birds busy scratching for food. If the quantity of litter is insufficient, open a bale of straw in the centre of the shed and allow the birds to scatter it over the floor. The litter supplied should cover the floor to a depth of about 4 inches. At the present time litter is costly, but it would be cheap in comparison with the value of the birds that may be lost from vent picking without its aid. Where litter is not available, some relief may be obtained by feeding a very small meal of wet mash twice each morning for several days. The feeding times could be at approximately 8 a.m. and 11 a.m., and the quantity fed at each meal need not exceed 4 lb. dry weight per 100 birds.

—*J. J. McLachlan.*

Veterinary First-Aid Chests.

TREATMENT OF COMMON AILMENTS IN STOCK.

ROSS NOTT, B.V.Sc., Government Veterinary Officer.

SINCE many cases of sickness in animals can be treated by the use of simple remedies immediately the illness is noted, it is very necessary that a supply of these should be kept always on hand in the form of a veterinary first-aid chest. In order that farmers and graziers may make proper use of these drugs, the following notes have been collected which summarise the uses of the drugs and the treatment for common ailments of stock.

It should always be kept in mind, however, that in every case where a contagious or infectious disease is suspected, graziers and farmers should report the outbreak immediately to their nearest Veterinary Officer, Stock Inspector, or to the Department of Agriculture and Stock, Brisbane, in order that measures may be taken for treatment and control.

Boracic acid is a mild antiseptic, and is used for eye lotions, mouth washes, and dusting powder for wounds.

Zinc oxide is useful as a dusting powder for wounds. An ointment can be made by mixing one part of zinc oxide with four parts of lard or vaseline.

Lysol is a powerful disinfectant, used for the treatment of suppurating wounds, and the sterilisation of instruments.

Mercury-perchloride tablets (corrosive sublimate) are a powerful disinfectant and antiseptic, used for the washing and irrigation of wounds. As, however, it will corrode all metals, it should not be used for the disinfection of instruments.

Camphorated oil is a mildly stimulating and soothing liniment. It is used for massaging the udders of cattle affected with mammitis (inflammation of the udder.)

Strong tincture of iodine is a strong antiseptic, used for the dressing of cuts and wounds. For use, one part of the tincture should be added to three parts of methylated spirits.

Zinc Sulphate tablets, each containing 10 grains, are used in the treatment of sore eyes where there is an opacity on the front of the eyeball. One tablet dissolved in 2½ oz. of boiled water and half a teaspoonful of boracic acid makes an efficient eye lotion.

Oil of turpentine, when administered internally with oil, will prevent fermentation. It may be applied externally as a disinfectant, and is useful for applying to wounds in conjunction with olive oil, or raw linseed oil.

Aromatic spirits of ammonia (spirits of sal volatile) is a general stimulant. The dose for a horse is 1 to 2 oz.; for sheep, ½ oz. to 1 oz.; for cattle, 1 to 2 oz. It is used as a stimulant in the treament of colic, but should be well diluted to prevent the irritation of the mouth.

Spirit of nitrous aether (sweet spirit of nitre) is a stimulant. It prevents griping, lowers the temperature, and is used in the treatment of colic and kidney trouble. The dose is the same as that for spirits of sal volatile.

Powdered nux vomica is a nerve stimulant, and is used for restoring tone to the bowels. It is beneficial in treating debility and other diseases in which the patient is weak. The dose for horses and cattle is one teaspoonful twice a day.

Sulphate of iron is a tonic and is also used in the preparation of the antidote to prussic acid poisoning.

Tincture of perchloride of iron is a tonic and is also used in the preparation of the antidote to arsenic poisoning.

Measures:—1 fluid dram = 1 teaspoonful; 1 fluid oz. = 1 tablespoonful; 2 fluid oz. = 1 wineglassful; 2 tumblerfuls = 1 pint; 20 fluid oz. = 1 pint.

In addition to the drugs and medicines mentioned, the following materials are generally obtainable from the home:—Copper sulphate (bluestone), turpentine, raw linseed oil, ginger, starch, treacle, honey, mustard, washing soda (carbonate of soda), baking soda (bicarbonate of soda), household cloudy ammonia, Condy's crystals, common salt, etc.

Digestive Disorders.

Colic in Horses.—(*a*) Impaction (stoppage of bowels); sand colic.—Give the following drench:—Raw linseed oil, 1-1½ pints; turpentine, 2 oz. Shake up thoroughly before giving. Follow three hours later with this draught, which can be repeated every three hours, if necessary:—Spirits of nitrous aether, 1oz.; aromatic spirits of ammonia, 1 oz.; treacle, 1 cupful; water, 1 pint. If there is no improvement in the case in 24 hours the whole treatment should be repeated.

(*b*) Flatulent (windy) Colic.—Give this drench:—Raw linseed oil, 1-1½ pints; turpentine, 2 ozs.; aromatic spirits of ammonia, 1 oz. (or household cloudy ammonia, ½ oz.).

(*c*) Spasmodic Colic.—Drench with the following mixture:—Aromatic spirits of ammonia, 1 oz.; spirits of nitrous aether, 1 oz.; treacle, 1 cupful; water, 1 pint.

Note.—In all cases of colic, the medicinal treatment should be supplemented with enemas of warm, soapy water. To do this a length of hose ½ in. in diameter and 6 ft. long, with a funnel in one end, is required. The hand, washed and oiled, carefully carries the free end of the hose as far forward as possible into the passage, and 3 to 4 gallons of the solution is slowly introduced through the funnel. The enema should be repeated every three or four hours if necessary.

The farmer should note that the condition often termed by him "stoppage of water" is generally a form of colic and should be treated as for impaction.

Indigestion in Cattle—(*a*) Impaction of the paunch; constipation; stoppage.—The following mixture should be used as a drench:—Epsom salts, 1-1½ lb.; household cloudy ammonia, ½ oz.; ginger, 2oz.; treacle, 1 lb.; warm water, 2 pints. (To mix, dissolve the salts in 1 pint of water and treacle in the other pint, mix together, and add the rest of the ingredients.) This drench should be repeated in 24 hours if necessary. In cases of impaction this should be followed up by a heaped teaspoonful of powdered nux vomica given night and morning for three days.

(*b*) Hoven or Bloat.—The following drenches are suitable:—No. 1—turpentine, 2 oz.; household cloudy ammonia, ½ oz.; cold thin gruel, 2 pints. No. 2—Condy's crystals (small teaspoonful) dissolved in a quart of warm water. The medicinal treatment should be supplemented by gagging and light exercise. In severe cases the paunch should be punctured on the left side, a trocar and canula or a clean sharp pocket knife being used for the purpose.

Digestive Disorders in Sheep.—The same treatment should be given as for cattle, one-quarter of the dose of the various drugs being used.

Indigestion in Pigs.—The following purgatives are suggested:—Castor oil, 1-4 oz. (according to size) in warm milk; or linseed oil, 2-8 oz. (according to size); or Epsom salts, 2-6 oz. (according to size). The purgative drench may be supplemented by putting the pig on to small, sloppy feeds.

Other Common Conditions.

Wheat Gorge and Laminitis (Founder) in Horses.—As soon as this condition is observed a drench made up of a solution of bicarbonate of soda (baking soda) should be given. The dose is one cupful of soda dissolved in a quart of water. This drench should be repeated, if necessary, every two hours. The patient should be allowed plenty of drinking water. Three hours after the first drench a draught containing—raw linseed oil, 1-1½ pints; and turpentine, 2 oz. should be given. The soda drench should be given night and morning on the two following days. Where stiffness of movement is present, the horse's heels should be lowered with a rasp and the animal stood in water during the day. It should be taken out at night and put on soft standing. A light ration should be given, but no grain.

Ergot Poisoning (Cattle).—A drench of any purgative mixture should be given without delay in order to get rid of the offending matter. A mixture of 1 lb. Epsom salts and 1½ oz. ginger, dissolved in one quart of warm water, would serve the purpose. If recovery is slow a tonic should be given, such as:—Sulphate of iron, 2 drachms; powdered nux vomica, 1 drachm; Epsom salts, 2 oz.; powdered gentian, 2 drachms. This should be mixed into a powder and given with treacle night and morning for 3 days.

Milk Fever.—The udder should be washed with lysol solution (tablespoonful of lysol to a pint of water). A boiled teat syphon, which has been attached to the enema syringe (the latter should also be put into disinfectant if it has been used for other cases) should be inserted into the teat and air injected into the quarter until it is quite firm. This should be repeated for each quarter. The teats should be tied with tape, which should be removed in two hours' time. The injection of air should be repeated in three hours if the animal has shown no signs of recovery. The patient should be kept propped up on its brisket after the injection.

Mammitis (Inflammation of the Udder).—The animal found suffering from this trouble should be isolated. Hot fomentations should be applied to the affected quarter, and it then should be massaged with camphorated oil (warm). This should be done three or four times daily, and it is important that the quarter should be stripped out many times during the day.

Further, the patient should be given a purgative drench as has been suggested for impaction of the paunch. The hands of the attendant should be disinfected before proceeding to milk healthy cows.

Inflammation of the Eye.—The eye should be examined carefully for the presence of foreign bodies, such as a piece of chaff. If any are present a few drops of castor or olive oil should be put into the eye sac, and the foreign substance removed with forceps. The following eye lotions are recommended:—

(1) Acid-boracic (two teaspoonfuls to the pint of boiled water). To this can be added 10 tablets of zinc sulphate (each tablet contains 10 grains).

(2) Where a white film is present over the eyeball, use perchloride of mercury solution (one tablet to six pints of boiled water).

Arsenic Poisoning.—The animal should be given as a drench a mixture containing $1\frac{1}{2}$ oz. tincture of perchloride of iron in a wine-glass of water, and $\frac{1}{2}$ oz. of carbonate of soda in a half tumblerful of water. This should be repeated, if necessary, at intervals of two hours. Lime water also should be given.

Prussic Acid Poisoning.—A mixture containing 1 oz. carbonate of soda in 1 pint of water, added to $\frac{1}{2}$ oz. sulphate of iron in 1 pint of water, should be given as a drench.

Treatment of Surgical Conditions.—(*a*) Bleeding.—This is best controlled by pressure. The most common method is to place a pad of cotton wool or clean linen cloth soaked in turpentine on the wound, and bandage tightly over it. If there happens to be a large vessel cut, and its end exposed, it can be clamped with artery forceps: A small pair of pliers which have been well boiled will do in an emergency. For severe bleeding a tourniquet may be applied (to a limb) above the wound. This may be improvised by tying a cord round the leg loosely, and then twisting a stick in it till it is so tight that it stops the circulation. It should be removed as soon as possible.

(*b*) Abscesses.—The swelling should be clipped and hot fomentations, or a blister of mustard and warm water (the consistency of table mustard) should be applied. When pointing occurs the swelling should be opened up at its lowest point so as to ensure drainage. It should be syringed out frequently with iodine solution made by adding tincture of iodine to water till a deep sherry-coloured mixture is obtained.

(*c*) Wounds in general.—In all cases cleanliness is essential. The hair should be clipped around a wound, which should then be washed with warm water and soap with a view to removing any foreign matter. The wound should be bathed with a disinfectant solution, e.g., lysol (1 tablespoonful to 1 pint of water); perchloride of mercury (1 tablet to 1 pint of water); tincture of iodine; turpentine. If practicable, a pad soaked in the disinfectant should be applied and a bandage put over it. Later dry dressings could be used. A useful one is made of equal parts of starch, zinc oxide, and boracic acid. A useful fly repellant is—lysol, $\frac{1}{2}$ part; turpentine, 1 part; olive oil or raw linseed oil, 20 parts.

(*d*) Punctured wounds of the foot.—These require special treatment. The wound should be well opened up so as to allow it to drain freely. It should be swabbed out with pure turpentine or lysol, and it

is essential that the wound should be kept clean. It should be fomented daily with a bran poultice, to which lysol or other disinfectant has been added.

(*e*) Lacerated wounds of the skin.—These should, where possible, be sewn after cleansing.

(*f*) Udder injuries, cracked teats, etc.—All wounds and contusions should be kept clean and smeared with ointment, e.g., zinc oxide ointment.

(*g*) Proud flesh on limbs.—This should be dressed daily by rubbing with a piece of copper sulphate (bluestone), and then bandaged tightly.

Administration of Medicines.

Liquids are most suitably given as a drench. Care should be taken in giving oil drenches to horses. The medicine should be well shaken, and given in small quantities. Rubbing, pinching, or other interference with throat or neck parts should not be indulged in. In drenching pigs a satisfactory method is to use an old piece of hose. Oil should be mixed with warm milk to make it run freely.

Powders are best given by mixing with treacle, honey, or jam to form a thin paste, which is then smeared on the back teeth and tongue with a thin flat stick.

SHEEP LANDS FOR GRAZING HOMESTEAD SELECTION.

KATANDRA RESUMPTION.

Portions 8 and 9, parish of Katandra, comprising part of Katandra resumption will be open for grazing homestead selection at the Land Office, Hughenden, on Thursday, 5th August, 1937.

The portions are situated from 16 to 20 miles south-easterly from Whitewood, on the Hughenden-Winton railway, and comprise very open downs country grassed with Flinders, Mitchell, Blue, Button, and other grasses and are suitable for woolgrowing and fattening.

Portion 8 is sufficiently watered, but more water will need to be provided on portion 9.

The areas of the portions are 35,931 acres and 36,091 acres respectively.

Each selection will be for a term of 28 years and the annual rents for the first 7 years are 2d. per acre and 1¾d. per acre respectively.

Each selection will be subject to the condition that the selection must be stocked with the applicant's own sheep within 3 years.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agent. Hughenden, and the Government Tourist Bureaux, Sydney and Melbourne.

The Importance of "Type" in Merino Flocks.

J. L. HODGE, Instructor in Sheep and Wool.

LORD Barnby, when visiting Australia on a wool publicity mission, referred to the importance of breeding to type and suggested that this was preferrable to undertaking elaborate woolclassing. This was not intended as a reflection on woolclassing, as some people thought; but apparently Lord Barnby desired to stress the importance of fixing a type in the flock and thereby *simplifying* woolclassing.

The importance of the advice given cannot be overestimated. Gen r-ally speaking, insufficient care is taken in mating the flocks of the State. The fixing of a type, or even the attempt to do so, is often sadly neglected. Far too many people are under the impression that rams of any type will do, whereas, in reality, the selection of a certain type of ram to mate with the ewe flock should be one of the major considerations of the year. It must be recognised at once that there are no short cuts to this desirable achievement and the question arises: How is this fixing of a type to be brought about in the shortest number of years?

Firstly, the ewes must be regularly culled, having in view the exact type of sheep required for a particular district. Apart from the covering, ewes would be discarded for other faults such as lack of size, malformation of any kind, devil's grip, or want of constitution or conformation, these being amongst the most commonly found faults in the average flock.

A line of classed ewes, having been secured, the ram should be chosen on the assumption that like gets like; but, taking into account also the rapid manner in which merino wools fine up under western conditions, it will be wise to select rams several counts stronger in the wool fibre than that of the ewes with which they are to be joined. A violent contrast such as really strong woolled rams on fine ewes, is not on any account to be recommended. This would be only an abortive attempt to do in one year that which, under the most favourable of conditions, cannot be accomplished under four or five years. The mating of sheep of very

fine wools with those of very strong wools results in the progeny throwing all ways instead of the medium, which was to be desired.

Many graziers fail to regard the purchase of rams from the right business angle. Granted the knowledge necessary to select the right type of rams, it needs only a simple sum in arithmetic to estimate the financial advantages to be derived from the choice of a higher grade of animal rather than the so-called cheapest flock rams. These rams are *not* the cheapest, and one crop of lambs should be sufficient to convince the grazier of a "penny wise, pound foolish" attitude. No additional expenditure on the property can be better justified than an extra amount spent in rams; provided, of course, that the grazier, or the expert he employs for the purpose, has the knowledge necessary to make the right selection.

The quickest way then to establish a type of merino sheep on the property is to combine an annual culling with the selection of better rams. Either of these operations is important and will give results, but one is incomplete without the other.

The selection of the stud from which the rams are to be purchased is of outstanding importance. The type desired must, of course, be procurable there. The age of a stud should be taken into consideration, because provided the stud has not slipped back, the prepotent power in the rams, or the probability of rams reproducing progeny like themselves, is more likely to be firmly established.

It is important in the fixation of type that, being suited by a particular stud, the grazier should stick to that stud unless a very good reason can be given for a change.

The joining of flock ewes with the rams there leads to what is called indiscriminate breeding. Apart from the culling of the ewes and the selection of the rams no attempt whatever at selective breeding is made. If the paddocks are available, it is safe to assume that, even amongst the flocks, something useful and profitable could be done in this way. Again on the assumption that like gets like, it appears to be well worth while to select carefully the ewes to mate with rams likely to suit them from a wool point of view, and thereby bring about some measure of selective breeding.

By way of helping the grazier in this respect, the Department of Agriculture and Stock has made a start with some stud breeders in the matter of typing the flock rams before sale. In the past, it has been a common practice, in cases in which rams of a certain type have been recommended, for the stud master to give a run of rams at a certain agreed price. This results frequently in a buyer getting fine medium and strong rams in direct opposition to the advice tendered with regard to type. The result is deeper and deeper culling and a loss of years in the establishment of the type suitable for the property and district.

In the selection of rams, it does not follow that, because a certain type is recommended for one district the same advice would be equally applicable to another part of the State. For far-western and central conditions, it should be the object of the grazier to produce a strict medium, and to accomplish this and keep it, it is necessary, as before pointed out, to use rams slightly stronger than the ewes with which they are to be joined. In areas nearer to the coast the production of

finer wool may be encouraged, provided that constitution is in no way sacrificed. It should always be remembered that of the two—price per head, or price per lb.—the sheep showing the former result should be chosen especially for the West and Central parts of the State where constitution plays such a big part in times of drought.

It may be thought from the foregoing that the writer holds a brief for the strong type of merino as against the finer wools. Such is not the case except where it is definitely proved that sheep of the stronger type are more likely to do well under adverse conditions. After all it is not a matter always of what individual graziers would like to breed, but a case of the choice of a particular type being made imperative in a particular district.

In the best interests of the sheep industry, it is not desirable for cull ewes to be passed on to a neighbour as breeders. It would be far better for them to be fattened and sold for the purpose of slaughter. There is no law against the selling of cull ewes as breeders; but the prospective buyer would be well advised to steer clear of such in the formation of his flock.

On certain properties where the culling of a definite percentage every year takes place, and the use of good rams has long been a definite policy, a good line of ewes may be secured. These, then, will require culling before the rams are joined.

Like everything else on the land, the question of fixing a suitable type on a certain property in a given district resolves itself into what is profitable and what is not. A bad sheep eats just as much as a good one; but the economic consideration goes further than that, inasmuch as a bad ewe reproduces her kind, or more probably still produces a lamb inferior even to herself.

The practice of culling therefor is definitely profitable to the grazier. A well constructed jetting or branding race is admirably suited to the purpose. The nearer ewes are to being full-fleeced the better for culling purposes. Culling should also apply to the ewe hoggets. Only those conforming to the type decided upon, and filling the bill in every other way, should be retained as future breeders.

Constitution is of paramount importance and, after that comes the covering. Density, length of staple, colour and quality are all necessary in the selected breeder. Quality does not necessarily refer to coarseness or fineness of the fibre, but embraces such characteristics as breeding and softness in handling. Quality, therefore, may be found in a strong wool just as often as in a fine wool.

No known domesticated animal responds so quickly to careful and selective breeding as the sheep. It is equally true that there is no shorter cut to increased returns than in the elimination of the unprofitable and the retention of the profitable animal.

From every point of view, the culling of the ewe flock, and the introduction of better rams with the object of fixing a type, has everything to commend it and nothing against it.

Having established a good flock, care should be taken to feed them adequately. Half the troubles in the flocks are brought about by overstocking at some period of the year. Under-nourished sheep lend themselves readily to the infestation of internal parasites, and are not

constitutionally able to withstand the attack. Then again, it is not possible for a half-fed sheep to produce either the fleece or the lamb which would be expected in the case of a properly nourished animal.

It should be apparent that not only should the quality and type of the flock be brought about in the manner indicated, but that having the flock, it is in the interest of the grazier to maintain the health of every animal in it at the highest point.

SELECTING NEW BANANA AREAS.

With the approach of winter, intending banana growers would be well advised to pay more than a little attention to the aspect of the areas shortly to be felled for the 1937 planting.

Of late years, bananas have been grown extensively and successfully on inferior forest country; but, in most instances, suitable aspects, assisted by good cultural methods, have been the chief reasons for success.

The ideal aspect, of course, is the north-east or northerly slope, with standing timber on all four sides to give the necessary shelter from strong winds. These aspects ensure the maximum amount of winter sunshine.

With sites facing any further into the east than north-east, great care should be taken that, as far as possible, the area is sheltered from the cold south-east winds. An efficient windbreak on the south side of an easterly patch should, therefore, be provided for in the clearing plan. The site chosen should be so situated that tall timber or hills at the top of the proposed area will not shut out the winter sun at an early hour.

A westerly slope is preferable to south-east, south, or south-westerly slopes, if heavy belts of timber block the not very frequent strong westerly winds. Many good bananas have been grown on westerly slopes of this description, chiefly because the areas in question receive the sun during the whole of the afternoon.

All southerly slopes should be definitely avoided, more particularly if there is open country for any distance around the proposed area, but if a southerly slope has to be used it must be well sheltered. Much more timber will have to be felled than is actually required for planting, to obviate the long shadows which standing timber at all close to the patch throws over the plantation. The limited period during which they are exposed to the sun is the chief objection to all southerly slopes. Southerly slopes possess some slight advantages over other aspects, in that they usually bear for a longer period and the fruit is less subject to banana thrips rust.

However, when one considers that a good warm-slope plantation will produce from one to three bunches to every one on the cold-slope areas, production costs, particularly to the grower on leased ground, enter so largely into the picture that intending growers with a choice of ground should always choose a warm situation to gain the best results from their work.

—*J. R. Horsley.*

Tomato Culture.

H. J. FREEMAN, Senior Instructor in Fruit Culture.

TOMATO growing is an important industry in Queensland. The fruits of the tomato plant serve a wide range of uses, for they may be eaten raw, as sliced tomatoes, or in salads. They may be made into soups, sauce, pickles, jam, preserves, and their possibilities for use in combination with other foods are only limited by the housewife's creative fancy.

Tomatoes are grown under a great variety of systems. They are almost universally grown in home gardens, and in fact few gardens are so small that there is not sufficient room for at least six or more plants. Indeed, it is surprising how far a few plants will go towards supplying the average family with an abundance of wholesome fresh fruit.

Commercially tomatoes are produced by market gardeners who may be found near any populated group, from the smallest to the largest towns.

Botanically the tomato belongs to the family Solonaceæ. It is a near relative of the potato, and is susceptible to many of the diseases of the latter. Usually it is easy to grow in our climate as a plant; but as a commercial field crop it requires care, skill, and knowledge of local climatic and soil conditions. Bountiful crops are often obtained on newly burnt off scrub land, but for continuity of commercial production land that is easily cultivated by either horse or motive power is the desired site, all other necessities being taken into consideration. Though some excellent results have been obtained from year to year from the old system of planting, i.e., allowing the plants to spread out over the surface of the ground, the necessity for early maturity and heavier crops, the prevalence of diseases and pests, and the consequent vital necessity to spray or dust, now warrants that very careful consideration be given to either the staking or trellising methods used by progressive growers and explained later in this pamphlet.

When interested commercially, irrigation in some form or other is almost indispensable, for to depend upon the natural rainfall often means that one has a crop only when everyone else has one, with the corresponding glut prices, or total failure, according to whether the season is wet or excessively dry. Since the pamphlet refers to tomato growing mainly from a commercial viewpoint, this factor cannot be too strongly stressed. The commercial grower must also be prepared to spray or dust, thus guarding against the several diseases and pests capable of ruining his crop. To neglect these precautions renders the cultivation of the tomato hazardous to a degree.

Plate 5.
TRELLISED TOMATOES.—Note young top growth.

SOIL REQUIREMENTS.

Although the tomato has a wide range of adaptation to various soil types, the actual sites selected for tomato areas must not be subject to frost, and should have reasonable shelter from high winds. The ideal soil is a fine alluvial loam with good fertility and efficient drainage, though some excellent crops are obtained frequently from basaltic soils in elevated areas.

The soil should be deeply cultivated and should not be subject to "caking" under any conditions. It should have good moisture-retaining properties, obtained by the possession of a liberal humus content. Whilst some soils are recognised as being ideal, it should be borne in mind that

tomatoes will grow in almost any reasonably good soil, provided a few precautions are observed and the weather conditions are favourable. It is not considered that a very rich soil is most desirable, for such often induces a tremendous leaf growth at the expense of fruit production. Such growth is particularly succulent and appears most susceptible to the attack of fungus diseases. Definitely a more suitable soil is one of good medium fertility, in really good cultural order, and to which the necessary fertilizer elements are supplied as required.

Plate 6.
A fine cluster of young fruit.

SEED-BEDS AND PLANTING.

The best of planning and management resulting in soil developed to a high state of fertility will be of little use if poor seed or plants are secured. Perhaps no one thing is more essential to a successful crop than securing good seeds or plants from good seed stock.

Several methods of raising seedlings are employed, each having its advantages or disadvantages as the case may be.

Perhaps the most common is to raise the plants in prepared seed-beds. Congregated thus the seedlings can, of course, be more easily sprayed and watered than is possible when the seed is sown in the field. It is vital that the plants be kept disease-free and vigorous. Tomatoes are very liable to soil troubles, such as nematodes and fusarium wilt,

therefore seed-beds should always be made on new soil. If necessary, the soil should be sterilized by one of the recognised methods prior to planting.

Various ways of sterilizing soil, such as with formalin and cheshunt compound may be employed. For the average farmer probably the simplest and most efficient is to apply intense heat to the soil prior to sowing the seed, and the following extract, taken from the departmental pamphlet "Tobacco Growing in Queensland," explains this fully.

"Before further preparing the seed-beds for sowing, the soil should be sterilized. There are several methods of doing this, such as by steaming, the application of boiling water, solutions of formalin or similar agents, but the most effective in general estimation and recommended for Queensland growers is by the application of direct heat from the firing of tree branches, brushwood, or similar heat-giving material, piled on the beds to such an extent as will, when fired, produce sufficient heat in the soil to cook a 4-oz. potato buried 3 inches deep, or an egg buried 5 inches deep. It is difficult to state the exact amount of material for burning purposes, but the equivalent of poles 3 inches in diameter laid side by side is regarded as likely to prove satisfactory. Successful sterilization of the soil is most readily accomplished when the amount of moisture therein is what is regarded as satisfactory for cultural operations. Excess of moisture is as undesirable as a deficiency, since in either case the penetration of the desired heat in the soil is less easily permitted.

"Properly burnt beds show a more or less reddish tinge of colour, while the soil is rendered more friable and breaks easily to a fine powder. The object of burning the beds as well as the soil for a couple of feet surrounding them is to destroy any fungus spores, weed seeds, insect or other life therein, that may cause damage to the young plants.

Time to Burn.

"The time to burn the seed-bed is preferably a few days or a week before it is desired to sow the seed.

Final Preparation.

"After the fire has burnt out and the soil has become sufficiently cool, all unburnt pieces of wood and large charcoal should be removed, and the beds and paths, disarranged when placing the firing material thereon, trimmed up to proper shape. The fine ashes from the firing should now be thoroughly incorporated with the soil of the seed-beds, which at the same time should be reduced to the desired degree of fineness by digging and raking, back and forth, to a depth of 3 inches and finally levelled off."

It is not a wise policy to raise seedlings twice in succession in the same bed. Seed-beds should be made in a sheltered position, open to the sun, well dug, and cultivated to a fine tilth. The surface texture should be fine, smooth, and reasonably firm. If the soil is very loose the surface will rapidly dry out and the germinating seed suffer as a consequence. The beds should be thoroughly moistened prior to planting the seed, thereby minimising the amount of watering necessary until the seedlings are showing above the surface of the bed. The seed should be sprinkled upon the slightly-firmed surface and covered lightly with sifted sandy loam, and this gently firmed by light pressure with a flat board. Some growers then apply a light covering of dry straw, stating that such action

assists germination. It would certainly help to keep the beds damp. Should this be done, a careful watch must be kept and the straw removed immediately the tiny seedlings appear above the ground. Only in extreme instances is artificial shade necessary. Subsequent treatment is to water the beds when necessary, and to spray the young plants with Bordeaux mixture at regular intervals in order to keep the young growth covered. Most growers transplant when the young seedlings are from 6 to 8 inches high.

In most instances sowing of seed should be made during April and May, if it is desired to market late winter and early spring crop. In districts where frost or cold winds are not a menace, and where irrigation is available, the sowing of seed can be made at almost any time. This, of course, is only practised where conditions are suitable to allow as nearly as practicable for a continuity of the harvest of the fruit. Normally six weeks should lapse between the sowing of the seed and the planting out of the seedlings.

Before setting the plants in the field it is essential that they be subjected to the process of "hardening off," which is brought about by gradually withholding water for a week or ten days before transplanting. Through this action the plants will tend to become tougher. This somewhat hardened growth is better able to withstand possible chilling temperatures, drying winds, shortage of water, bright burning sunlight, and the shock of transplanting.

Immediately prior to transplanting, the beds should have a good watering and the plants should be removed during the ensuing two or three hours. They must be kept moist and fresh whilst the planting proceeds. All leaves, except the undeveloped crown leaves, should be pinched or cut off to mimimise transpiration until the root system is re-established. The best method of planting is to dibble the holes and water in each plant. The plants should be set as nearly as possible at a depth ranging from 3 to 6 inches, according to the size of the seedlings. Transplanting provides an opportunity for the selection of the best plants and for the discarding of the small, spindly, or malformed ones. Only the best should be used. A well-grown plant is an important factor towards a profitable crop.

A second method of planting tomatoes is to sow three or four seeds direct in the field at distances and in rows where the plants are to be grown. This is an improvement on the seed-bed method for the reason that there are no broken roots to give ingress to fusarium wilt and no setback, as at transplanting time. However, sufficient rainfall is always necessary to make satisfactory germination and growth. Attack from cutworms must also be guarded against, but if the grower can overcome these disadvantages then planting direct in the field has many points to recommend it. With a good strike some thinning is necessary.

Possibly the most efficient method of all for the grower who will take pains to eliminate every risk is to prepare tubes of bitumen roofing material and grow the seedlings in these. The procedure is as follows:—Wooden trays are constructed about 3 feet by 2 feet to hold the tubes. The tubes are made of pieces of bitumen roofing material rolled up and held together by a loop of string. One end should be plugged. The grower from whom this idea originated uses plugs cast in cement, but short pieces of round timber would do equally well. The tubes should be filled with compost and stood upright in the trays, and two or three seeds put in each.

The first advantage of this method is readily apparent, for the trays of seedlings can be kept clear of cutworms and other pests, and if necessary carried to shelter during inclement weather.

When the seedlings have produced their first rough leaves the trays are carried to the plot, a hole dibbled, the plug removed, the string cut, and the tube containing the plant planted in the hole and removed, leaving the plant with its roots quite undisturbed *in situ*. Eventually, one plant is left, the remainder being pinched out.

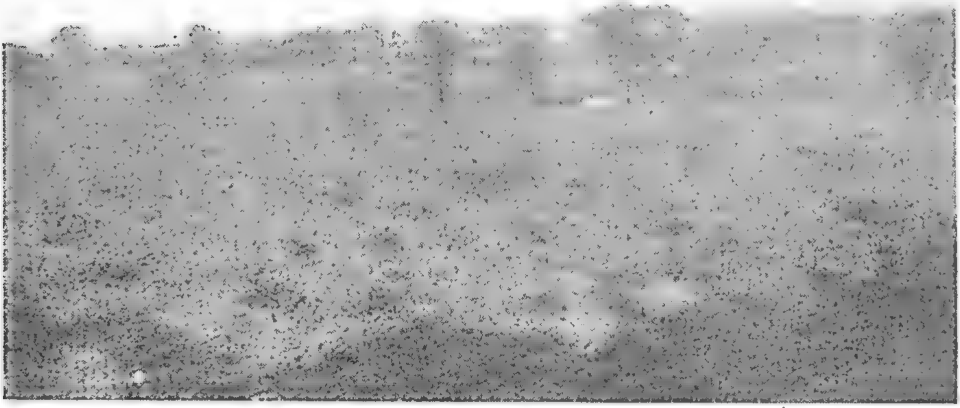


Plate 7.

A GROUND CROP, REDLAND BAY.—Note apparent difficulty in harvesting as compared with a staked or trellised crop.

The second advantage is that the seedlings can be planted out safely in any reasonable weather, since the roots suffer no disturbance, and, remaining unbroken, are less liable to be attacked by fungi. By the time of planting, the plants have also attained a fair size when they are exposed to the attacks in the field of cutworms, &c., and risk of loss from pests is less.

It is claimed that tomatoes grown by this method are several weeks ahead of those planted in the usual way. The trays, tubes, and plugs will all last for years, and, since most of the preparation can be done during odd moments or on wet days, there is really no extra trouble incurred. It is actually an adaptation of the gardener's practice of pricking out his seedlings into thumb pots preparatory to planting them out in the flower beds, and this can be recommended strongly.

An ounce of seed germinating 95 per cent. should produce approximately 2,000 plants.

PLANTING SYSTEM AND PRUNING.

One must differentiate between the methods used for obtaining a quick crop off newly burnt off scrub or lantana land and those followed by the established market gardeners. In the former the plants are usually set out 4 to 6 feet by 6 feet apart (approximately 2,000 plants to the

Plate 8.
An Irrigation Pipe Line.—A great advantage in successful tomato production.

acre), in the more or less uncultivated ground, and are allowed to spread, unpruned, over the land. The same practice is adopted by some growers working on ploughed tomato fields, but of recent years this policy has not been advocated especially upon land that is easily cultivated. The main objection is that the resulting crop may be anything from extremely good to a total failure, according to the weather and disease and pest incidence. Much fruit is often lost through slug and insect damage, or scalded from resting on the hot ground.

Plate 9.
Trellised System.—Young plants midway between the lower and upper wires.

Plate 10.

STA[illegible] TOMATOES.—Carrying a good crop. Note height of plants.

Plate 11.
STAKED BREAK O'DAY.—Showing a good crop.

Staking or trellising are both methods that have much to recommend them. Briefly, the system is as under:—

Staking.

Hardwood stakes are placed in rows 15 to 18 inches apart with 3 feet 6 inches to 4 feet between the rows. Each stake should be 5 to 6 feet in length, and when driven into the soil should retain a height of at least 4 feet. This allows for approximately 8,000 plants and a corresponding number of stakes to the acre. The plants are trained from the outset to single stems. All lateral growths are pinched out as soon after forming as possible. The leaves from whose axils they grow are, of course, left. The single stems are tied every 12 to 18 inches to the stake by strips of soft rag or binder twine. The ties are made loosely so as not to constrict the expanding stem and are positioned beneath a leaf. The actual action consists in passing the tying material round the plant stem immediately below a leaf, crossing it over itself, and then passing it round the stake twice before knotting, so that the plant is attached to the stake by the loops of a loosely-made figure eight. Finally, the growing tip is pinched out when the plant reaches the top of the stake.

Plate 12.
PICKING TOMATOES.—Advantage of trellis system.

Trellising.

One method of trellising is to set heavy hardwood posts firmly in the ground 4 feet apart at each end of the field. These are solidly stayed and bored to carry two plain wires of, say, 12 gauge. Good hardwood stakes bored and driven into the ground every 12 feet are all that are required for intermediate supports. The top wire is strained at about a 4 feet 6 inches height, whilst the lower is strained at approximately 1 foot from the ground. The young plants are set out beneath the lower wire, trained to two stems and enabled to reach the top wire by means of strands of binder twine tied in "V" fashion thus:—

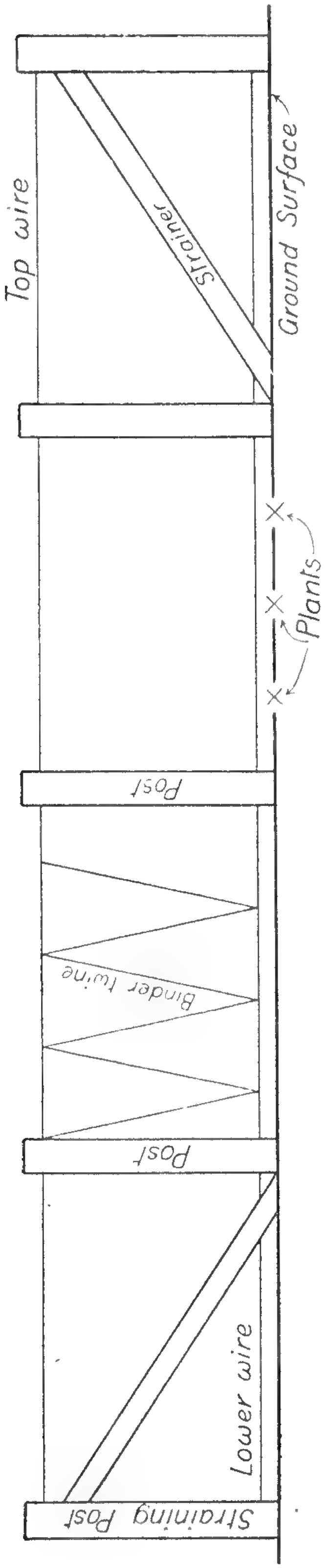


Plate 13.
Diagram showing material required and how to erect a trellis for tomatoes.

Plate 14.
TRELLISED SYSTEM.—Note position of strainers and distance between posts.

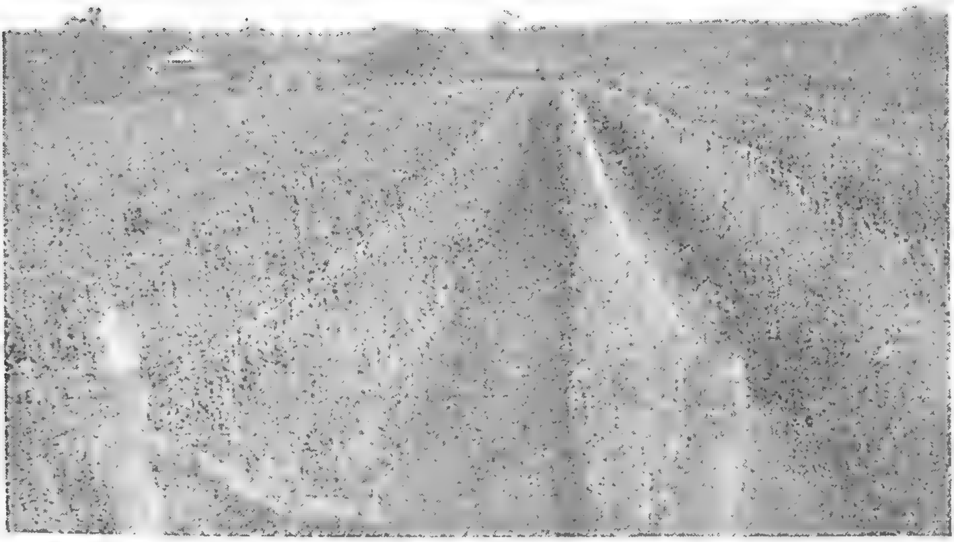


Plate 15.
A GENERAL VIEW OF A TRELLISED FIELD.—The first pick had been taken from this crop.

It is necessary to prune and eventually to pinch the head of the plant off as has been recommended in staking. The fruit produced by either of these methods is grown under the best possible conditions.

Plate 16.

A FINE SHOWING OF YOUNG FRUIT.—Note closeness of plants and height of growth.

Sprays and dusts for disease and pest control can be applied with greater economy and efficiency, the result being a high percentage of first quality fruit and a heavier crop. Cultivation also can be continued close to the plants, thereby conserving moisture and suppressing all objectionable weed growth. There is a minimum risk of damage to the fruit and the crop reaches maturity considerably in advance of fruit grown on plants unstaked or untrellised. Harvesting is quicker and more satisfactory, since the matured fruit ready to pick can be seen at a glance without having to pull the plants about. After the crop has been harvested, posts, stakes, and wiring can all be removed and stacked until required for erection on fresh land for the following season's planting.

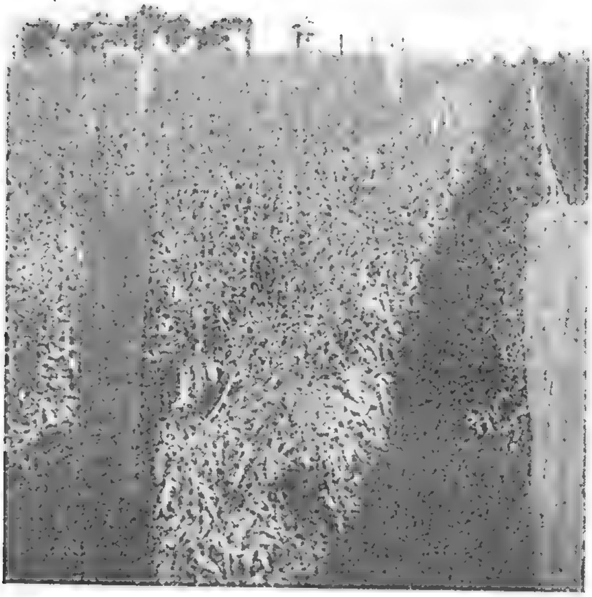


Plate 17.
TRELLISED TOMATOES.—Note spacing between rows.

FERTILIZING.

As mentioned previously the tomato does best in a soil of original medium fertility, but of good humus content. An excess of nitrogen such as is produced by very heavy dressings of stable manure alone tends to produce an abundance of succulent leaf growth at the expense of a satisfactory crop of fruit. This effect is neutralised by the application of from 150 to 300 lb. of a mixture consisting of 2½ parts of superphosphate to one of sulphate of potash per acre, which will definitely tend to check excessive vine growth, result in an earlier maturity of fruit, and materially increase the yields. It will be seen therefore that although the tomato requires a fertile soil, it is very sensitive to an unbalanced nutrient condition. On soils of moderate fertility a complete fertilizer, such as 4-12-12 or 4-16-12, applied at the rate of 300 to 500 lb. per acre should prove most beneficial. Such a formula as 4-12-12 is obtained by mixing together 420 lb. sulphate of ammonia, 700 lb. superphosphate, 560 lb. bonedust, and 560 lb. sulphate of potash, thus making 1 ton of fertilizer. The formula 4-16-12 would require a greater amount of superphosphate. (The chief fertilizer firms supply ready mixed fertilizer to these formulæ.) The fertilizer should be applied in the row and mixed well with the soil before setting the plants. Where very heavy applications are necessary, the fertilizer should be applied at the side of the row or broadcast, the purpose of this being to avoid injury to the roots and stems of the newly-planted seedlings. A side dressing of from 50 to

100 lb. of sulphate of ammonia or nitrate of soda applied one month after transplanting is often beneficial. The method of application is to open furrows about 2 or 3 inches deep on both sides of the rows, about 9 to 12 inches from the plants, and apply the fertilizer along these small furrows which should then be covered in with loose friable soil. Top-dressing with from 75 to 100 lb. per acre of water-soluble inorganic fertilizer, made up on a 4-11-10 formula, is practised with beneficial results under certain conditions. Such a formula is obtained by mixing together 490 lb. sulphate of ammonia, 1,265 lb. superphosphate, and 485 lb. sulphate of potash, making 1 ton. In average soils the application of lime to tomato ground does not seem directly to benefit the tomato crop, but is often indirectly beneficial as a result of its effect on other crops planted in rotation.

Plate 18.
A fine crop of trellised and irrigated tomatoes, Redland Bay.

It must always be remembered that the humus content of the soil must be kept up and rotating the land with a green crop appears to be the most satisfactory method to adopt. In considering this, regard to nematode control arises, for, unfortunately, the tomato is highly susceptible to these soil animals, and most of our areas devoted to market gardening are infested to a varying degree. A non-susceptible green crop is, therefore, most desirable and *Crotalaria goreensis* can be recommended for such purposes.

VARIETIES.

Every tomato grower should keep himself well informed in regard to varieties. Constant attempts are being made by individual growers and through departmental experiments to improve tomato varieties and to develop new and better types, the results sometimes being satisfactory. Considering such facts, a selection for Queensland home gardens could be made from the following:—Earliana, Bonnie Best, Break O' Day,

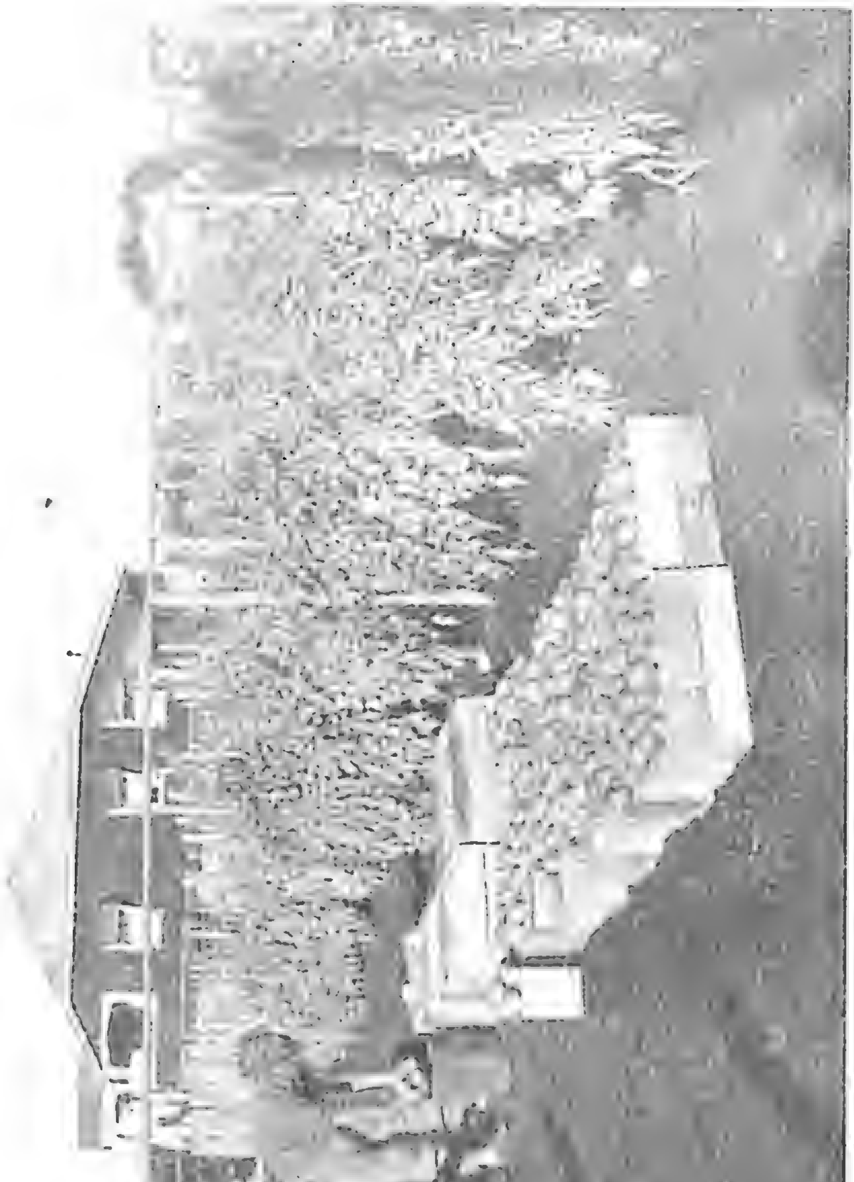


Plate 19.

Marglobe, and Ponderosa. A good list for the market gardener could be selected from the following, which are placed in order of maturity:—

Early Varieties: Earliana, Earliwinner, Kondine Red, Bonnie Best, Break O' Day, June Pink, and Chalk's Early Jewel.

Mid Season: Marglobe, Burwood Prize, Improved Stone, Bowen Buckeye, Norton, and Red Marhio.

Late Varieties: Targinnie Blue, Ponderosa, and Australian Large Red.

The following varieties are of wilt resistant strain:—Break O' Day, Marglobe, Red Marhio, Bowen Buckeye, and Norton. Much has been said in favour of wilt resistant varieties, and in districts subject to wilt damage more extensive plantings of these varieties could be recommended.

Between the earliest and the latest maturing varieties in the one season would be a difference of approximately thirty days, i.e., if all plants were planted on the same date. Earliana is one of the quickest to mature, whilst Ponderosa usually takes the longest of the recognised commercial varieties.

PESTS AND DISEASES.

In Queensland the main diseases affecting tomatoes are:—Irish blight, fusarium wilt, bacterial canker, target spot, septoria leaf spot, blossom-end rot, and the virus diseases spotted wilt, mosaic, and big bud, whilst the more important pests of tomatoes include cutworms, corn-ear worm, green vegetable bug, Rutherglen bug, tomato mites, and nematodes.

Information regarding these and other pests and diseases is obtainable from officers of the Division of Entomology and Plant Pathology, Department of Agriculture and Stock, at Brisbane, Stanthorpe, Toowoomba, Nambour, Rockhampton, and Atherton.

QUEENSLAND SHOW DATES FOR 1937.

July.

Nambour—	
Show	15th and 16th
Campdraft	17th
Esk	16th and 17th
Charters Towers	20th to 22nd
Laidley	21st and 22nd
Maleny	22nd and 23rd
Cairns	27th to 29th
Gatton	28th and 29th
Barcaldine	28th and 29th
Emerald	28th and 29th
Caboolture	30th and 31st

August.

Crow's Nest	4th and 5th
Home Hill	6th and 7th
Royal National, Brisbane	16th to 21st
Wynnum	27th and 28th

September.

Imbil	3rd and 4th
Ingham	3rd and 4th
Pomona	10th and 11th
Tully	10th and 11th
Rocklea	11th
Innisfail	17th and 18th
Malanda	22nd and 23rd

October.

Ravenshoe	8th and 9th
Millaa Millaa	1st and 2nd

November.

Murwillumbah	3rd and 4th

Green Manuring the Orchard.

R. L. PREST, Instructor in Fruit Culture.

MUCH has been said and written by agricultural experts throughout the world on the subject of green manuring generally in the orchards and the field; but, although the more progressive growers have adopted this annual practice, it is unfortunate that many have failed to realise how necessary it is to the success and longevity of their orchards.

By green manuring is meant the growing of suitable green crops in the orchard to be turned under to rot down as humus, and by this means improve the soil texture and assist in maintaining fertility. Growers will more readily appreciate the importance of this practice, when it is recognised that humus, the product of the decay of organic substances, is one of the most important ingredients in any fertile soil, and, generally speaking, is only present in inadequate amounts in most of the soils in our citrus growing areas.

Plate 20.

Winter Green-manure crop of young Lupins in the Citrus plantation.

Except in alluvial lands, periodically improved in fertility by flooding, the orchardist must consider the maintenance and improvement of the soil fertility if he wishes to harvest good crops. The application alone of artificial manures is of little value, when not supported by soil humus. Where animal manures are available, their incorporation with the soil is most desirable; but, in the absence of bulky, organic farmyard manure, the maintenance and improvement of soil fertility may be carried out by growing and turning under green manure crops. Apart from building up the physical condition of the soil, their growth during the rainy season reduces soil losses by erosion.

By the ploughing under of some succulent rapid-growing green-manure crop, the soil is enriched by the addition of certain essential plant foods. The carbon, oxygen, and hydrogen of plants come largely from the air, and the turning under of a crop, therefore, increases the store of such elements in the soil. The compounds that result from the crop decay increase the absorptive power of the soil and promote aeration, drainage and granulation—conditions of importance where successful plant growth is concerned. If the crop turned under is a legume, and the nodule organisms are active, the store of soil nitrogen is increased.

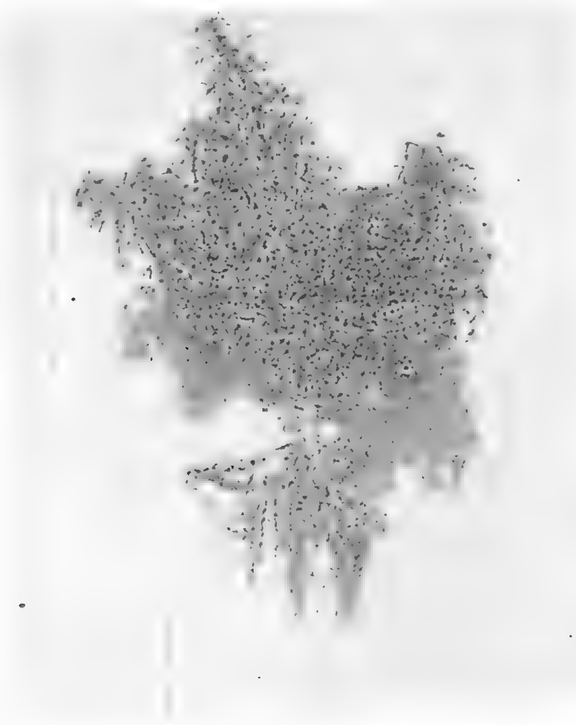


Plate 21.

New Zealand Lupin—Note root nodules.

Green-manure crops may also function as a cover crop, in so far as they take up the extremely soluble plant foods and prevent their loss in the drainage water. Green-manure crops, especially those with deep roots, absorb plant food from a great depth, and when the crop is turned under, this material is deposited in a more available form nearer the tree root zone.

When planning the growth of green-manure crops, care should be taken to avoid, as far as possible, their competition with the trees for soil moisture, particularly during the active period of tree growth and fruit development. Under no consideration should trees be permitted to suffer from lack of moisture.

In coastal orchards the general practice should be to utilise the summer rains. By planting about late November, a good germination may usually be obtained, since, under ordinary weather conditions, November is showery. The crop may then be permitted to grow until

about the end of February, which period will cover the rainy season, ensuring a good bulk for turning under, and incidentally checking soil erosion.

Plate 22.

Reconditioning Passion Vine soils. Green-manure crop of Mustard ready for turning under.

Plate 23.

Winter Green-manure crop of Field Peas and Skinless Barley in a Citrus plantation.

The districts in which irrigation facilities are available, or where autumn and late rains are seasonable, will be best served by planting late autumn and winter green-manure crops. Such crops, however, should not be permitted to grow over into the active spring period.

In newly planted orchards, trees up to four or five years of age seldom occupy more than a relatively small proportion of the total area upon which they have been planted. This factor may be early utilised to build up a reserve of vegetable matter in the soil by thickly interplanting cover crops up to four or five years. The tree roots do not extend far from the trunk and do not take up the amount of space occupied by those of older established trees. Thus cultivation may be confined to the immediate vicinity of the trees; and by far the greater amount of space down the centre of the tree rows may be occupied in growing both summer and winter green crops. A strip along each side of the tree is thus being cultivated frequently.

Plate 24.

Summer Green-manure crop of Crotalaria in a Custard Apple plantation.

The choice of the particular crop to grow will depend upon the season, the amount of water available, and the length of growing period available.

As the main essentials of a desirable green crop are rapid and succulent growth, it is of considerable benefit to apply a light dressing of fertiliser when sowing the crop. Both legumes and non-legumes will benefit considerably by the presence of phosphates in the early stages of growth, whilst in some soils nitrogen as well as phosphates may be required to produce good growth.

Though as yet the most desirable plant to use as a green-manure crop has not been found, there are at least two or three that have proved satisfactory for summer crops. Planted during November and December

as seasonal conditions permit, Crotalaria, Poona Pea, and Black Cowpea have done well, particularly where sown with superphosphate. The addition of one to two hundredweight of superphosphate per acre at seeding will be found to give excellent results. On poor and exhausted soils, the addition of a little sulphate of ammonia or nitrate of soda at the rate of ½ cwt. to the acre will be of material assistance to the cover crop.

Plate 25.

Reconditioning Pineapple soils. Green-manure crop of Maize ready for turning under.

Under normal conditions these plants will have made satisfactory growth and produced a good body of succulent tops for turning under during March and April.

For the winter green-manure crop, field peas and barley, tick beans, mustard, and in some districts lupins and vetches have proved satisfactory.

Planted in March, good bodies of material have been ready for turning under in June. Here again, except perhaps in practically virgin soils, it is very desirable that a suitable fertiliser be used at planting to ensure quick growing and succulent plants.

Some Tropical Fruits.

No. 15 THE MABOLO.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

THE Mabolo is a member of the Order Ebenaceae, or Ebony family, and is closely related to the Sapotaceous fruits. The tree is slow growing and takes many years to reach its ultimate height of about 30 feet. Its chief value lies in its ornamental appearance rather than in its fruit production, for although the tree crops heavily the fruit is of mediocre quality.

The native habitat of the mabolo is the Philippine Islands and the East Indies. Outside these countries it is only infrequently met with, usually planted as a specimen in tropical fruit gardens or parks. Specimens in Queensland are very limited in number.

Plate 26.
A three-year-old Mabolo Seedling, illustrating the slow growth.

The tree is usually raised from seed which germinate readily enough in loamy sand. The growth of seedlings is very slow and it takes a considerable time for the plants to reach a suitable size for planting in the field.

The foliage of this plant is distinctive in that, while the upper surface of the leaves is dark-green and glossy, the under surface is of a greyish colour and heavily pubescent. The leaves are of fair size, being 8 to 10 inches long by 3 to 4 inches wide, and are borne laterally along the smaller growths. During September flower buds are produced in all the leaf axils of the season's lateral growths, the flowers being directed downwards beneath the leaves. The flower has a cumbersome appearance with its four strongly recurved fleshy, cream-coloured petals opening

out over a like number of large erect sepals. Only a comparatively small number of flowers produce fruit, but even so a heavy crop usually results. The fruit is undoubtedly of striking appearance. Shaped similarly to one of the flat type of persimmon, it retains the sepals throughout its growth as does its persimmon relative. The skin of the fruit is thickly covered with fine needle-like hairs, giving it a velvety appearance. The colour is rusty-brown tinged in the young fruit with green, but assuming a reddish hue when ripe. On cutting the ripe fruit across it will be seen that it consists of a white mealy flesh covered

Plate 27.
A Mature Tree about Forty Years old.

by a thin skin. The star-shaped disposition of the seed cavities which is characteristic in sapotaceous fruits, is retained in this fruit also. The first taste of the fruit does not create a favourable impression and further acquaintance with it only modifies that impression in a small degree. The fruit cannot even be classed as of fair quality. A peculiarity the fruit shares with quite a number of tropical fruits is the remarkably strong scent of the ripe fruit. Although not unpleasant this scent becomes overpowering in a closed room. The ripening season

in North Queensland is January to March, but odd ripe fruits will sometimes be found at other seasons.

In regard to soil for the mabolo, trees are growing well in the North on rich alluvial loam and fairly well on loamy sand kept well moistened.

The fruit-sucking moth is very partial to this fruit which it sucks out, leaving only a spongy mass. Fruit fly also attacks it readily.

Plate 28.
The Mabolo Fruit.

Several common names are applied to this fruit. In its native habitat Mabolo is the common name. In other places it is called "Velvet apple" (from the velvety appearance of the fruit), and "Butter fruit" (probably in allusion to the buttery consistency of the mealy flesh). Botanically it is known as Diospyros discolor.

Efforts to propagate the tree vegetatively have been made in the Philippine Islands by P. J. Webster, who found that shield budding may be successfully practised. Unless better varieties exist in that country than we have in Queensland, however, such propagation of this fruit would be hardly worth while.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

THE advent of the cold weather has affected the values of many different fruits on the various markets, particularly bananas and citrus. With the shortage of supplies, however, this should be only of a temporary nature.

Growers who have shown a tendency to harvest fruit before it is actually ready, so that they could avail themselves of the high prices prevailing, will now cease their efforts in this direction, and consequently the quality of winter fruit should be enhanced from the consumer's point of view.

Complaints are still received about the marketing of green papaws. This fruit is only now becoming known to the Southern people, and at this juncture, whilst the market is being developed, it would be best to send only first quality fruit. Many hundreds of tourists travel from the Southern States to Cairns, where at this period of the year first quality fruit is obtainable, and these people, returning to the South with a taste developed for tropical fruits, are naturally disappointed if they are sold a poor quality fruit.

A similar situation exists in respect to custard apples, many growers in the past having spoiled the market by sending in immature fruit. The development of a taste and outlet for tropical fruits will be a slow process, but to this State should more than repay the work entailed. Queensland has a monopoly in the production of these fruits, so that any expansion of markets must benefit only the growers of this State.

The following is a summary of the market prices obtaining during the month:—

TROPICAL FRUITS.

Bananas.

Melbourne prices for cased fruit were as follows: Eights and Nines, 18s. to 19s., Sevens 16s. to 17s., Sixes 14s. to 15s. On the Sydney market the continued cold weather during June caused a considerable drop in prices, so that Eights and Nines sold at from 15s. to 18s., Sevens 13s. to 16s., and Sixes 10s. to 14s. In Brisbane Eights and Nines brought 13s. 3d. to 16s. 6d., Sevens 12s. 9d. to 15s. 9d., and Sixes 9s. 3d. to 14s. 3d., while Lady's Fingers sold at from 3d. to 6¼d. per dozen.

The returns for the bushel case consignments sent to the Melbourne market were very satisfactory, comparing favourably with those obtained for similar fruit in tropical cases. Unfortunately for the experimental consignments, many growers despatched fruit to the Sydney market. This was not desired at the time, and it was not surprising that returns were definitely unsatisfactory. At a conference held at Murwillumbah it was decided that marketing bananas in clusters and in the bushel case be optional, the regulations, as at present gazetted, being applicable.

Pineapples.

Complaints regarding the marketing of green fruit are still being received; in their own interests growers should remember that winter conditions are now prevailing, and send only mature fruit.

Smoothleaf pines in Melbourne brought from 9s. to 12s. per case, and in Sydney 8s. to 13s. per case. Brisbane prices were from 4s. 6d. to 8s. per case, or for loose fruit from 2s. to 6s. per dozen. Roughs realised from 3s. to 6s. per case in Brisbane, and from 1s. to 4s. per dozen loose.

Custard Apples.

Market prices ranged as follows: Melbourne 4s. to 6s., Sydney 2s. to 5s., and Brisbane 2s. to 3s. per half bushel.

Papaws.

Melbourne prices were from 14s. to 18s., and Sydney prices from 16s. to 20s. per tropical case. In Brisbane Yarwun fruit realised from 9s. to 11s. per tropical case; Gunalda fruit from 6s. 6d. to 7s. per bushel; and local fruit from 4s. to 6s. per bushel, with specials to 7s.

Avocados.

In Melbourne avocados sold at from 12s. to 14s. per case, and in Brisbane choice lines at from 8s. to 9s.

Granadillas.

Supplies were generally light, from 6s. to 10s. per dozen being obtained for prime large fruit.

Passion Fruit.

Sydney prices ranged from 8s. to 12s. per half-bushel case, and Brisbane prices from 4s. to 6s. for second grade fruit; from 7s. to 8s. for first grade, and specials higher.

CITRUS FRUITS.

Oranges have maintained values at a steady rate. Mandarins slumped for a few days at the end of May, but have again reached higher levels and should now maintain prices. Queensland grapefruit of first quality has sold at high rates in Melbourne and Sydney, but the taste for this fruit on the part of the Brisbane public appears to require more development, as the demand at present is not great.

Oranges.

In Brisbane commons realised from 6s. to 8s. per bushel, with specials to 9s., while Benyenda fruit sold at from 8s. to 10s. and Gayndah from 7s. to 9s. 6d.; Navels sold at from 8s. to 11s. per case. In Sydney from 6s. to 8s. per case was obtained for local Navels, and from 3s. to 7s. for commons.

Mandarins.

Brisbane prices were as follows: Local Glens 5s. to 10s., Gayndah Glens 8s. to 12s., Benyenda Glens 10s. to 12s., Fewtrells 4s. to 5s., Emperors 4s. to 9s., Scarlets 4s. to 7s. Sydney prices were from 6s. to 13s., and Melbourne from 9s. to 12s.

Grapefruit.

In Melbourne prices up to 16s. per bushel were obtained for Queensland Marsh Seedless, while in Brisbane from 6s. to 8s. per

bushel was obtained for local fruit, and from 9s. to 11s. for Gayndah fruit.

Lemons.

Sydney prices ranging from 2s. to 8s. per bushel were realised, and in Brisbane from 10s. to 15s. for Gayndah fruit and from 7s. to 10s. for others.

DECIDUOUS FRUITS.

Practically all supplies of apples and pears are now being obtained from cold storage. Owing to the heavy supplies of fruit held in storage, growers with fruit in store are advised to spread their marketing over a period instead of endeavouring to beat the market with haphazard consignments.

Apples.

Stanthorpe Granny Smiths sold at from 8s. 6d. to 10s. 6d. per bushel case, and imported apples as follows: Jonathan 7s. to 10s., Cleopatra 5s. to 7s. 6d., French Crab 5s. to 7s., Granny Smith 6s. to 10s.

Pears.

Prices were as follows: Winter Cole 6s. to 13s., Winter Nelis 7s. to 10s., Packhams 6s. to 8s., Josephine 7s. to 9s., other varieties 7s. to 8s. per bushel.

OTHER FRUITS AND VEGETABLES.

Strawberries.

Brisbane prices ranged from 6s. to 10s. a dozen boxes, with choice berries from 13s. to 16s., and a few specials higher. In Sydney trays realised from 7s. to 9s. each, and boxes from 11s. to 15s. per dozen.

Cape Gooseberries.

The Brisbane price was from 6d. to 7d. per lb.

Tomatoes.

In Brisbane ripe tomatoes sold at from 1s. to 3s. per half-bushel, green from 1s. 6d. to 3s., and coloured from 2s. to 5s. Small fruit is not popular. In Melbourne Queensland fruit realised from 3s. to 5s.

Cucumbers.

Prices realised in Sydney were from 2s. to 5s. per case, and in Brisbane from 4s. to 5s.

Other Vegetables.

Brisbane prices for beans were from 9s. to 12s. per bag, for peas 8s. to 11s. per bag, and for lettuce 6d. to 1s. 3d. per dozen.

PUBLICATIONS.

A booklet on strawberry packing will be available for distribution shortly.

COTTON.

The combination of killing frosts occurring in most districts around the 19th of May, and the bright windy weather prevailing through June, has hastened the opening of the crops. The completion of harvesting is therefore well under way in all districts, for, as a rule, only a very light top crop has been produced. The volume of cotton arriving at the two ginneries still continues at a substantial rate, however, and it would appear that a slightly higher total will be obtained than appeared likely at the end of May. The quality and grades of the average cotton being received still are remarkably good considering the season.

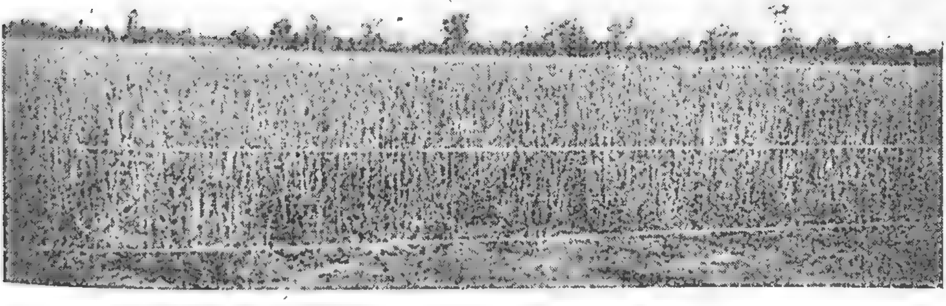


Plate 29.

A wheat crop at Charleville, South Western Queensland, grown under conditions of natural rainfall.

SUGAR.

Weather conditions for the first part of the month were uniformly dry, with relieving showers in central and northern areas. Cold droughty conditions have prevailed in the southern part of the State.

Practically all northern mills have now commenced crushing with reasonably good sugar content of cane. Dry weather and pest damage have considerably reduced crops in the central district, while the outlook for the current season in the southern part of the State is not good. Final estimates of crops have not yet been completed.

Plate 30.

A WESTERN WHEATFIELD.—A good crop grown under "dry farming" conditions near Charleville.

USE CERTIFIED POTATO SEED.

The spring crop of potatoes in Queensland suffers considerably from the presence of virus diseases, including mosaic and leaf roll. These diseases are not always recognised by the potatogrower, who ascribes the abnormalities produced to a variety of causes. The crinkling and slight mottling of the mosaic plant and the curling of the leaves in the leaf roll affected plant are often thought to be due to the action of dry weather or insect pests. Sometimes the abnormal plants are thought to belong to another variety of potato. Actually they are caused by virus diseases, which considerably reduce the yield. Sucking insects are responsible for the secondary spread of the diseases, but the principal loss is due to primary infection, which comes from the seed potatoes. The tubers from affected plants are numerous, but small, and as a result the yield is low in quantity and poor in quality.

The only practicable control measure for these diseases is the use of seed tubers free from virus. One cannot detect virus infection in the tubers, and the only means of ensuring that they are free is to examine personally the crop from which they are produced. Seed from potato crops, which have been regularly inspected and conform to certain required standards, is available at least in New South Wales. This seed, known as certified seed, commands a better price than the ordinary lines, but even a small improvement in crop value will more than repay any additional planting cost. A list of the available sources of certified seed may be obtained on application to the New South Wales Department of Agriculture.

R. B. Morwood.

ROOT CROPS FOR PIGS.

Successful pig raising depends largely on the production on the farm of suitable root crops. The crops should be fed to the pigs on the paddock system which permits the animals to do some of their own harvesting, and also suits their natural inclination to graze and search for roots.

Under normal seasonal conditions there are many root crops which possess a high food value and are more or less resistant to the immediate effects of dry weather.

Root crops recommended for pig feeding include sweet potatoes and English potatoes (after picking out the marketable potatoes, there always remain the small and broken tubers), Swede turnips, mangel wurzels, and several varieties of sugar beet. Arrowroot is worth consideration as a carry-over crop, while, in Central and North Queensland, varieties of cassava are worth cultivating in heavy types of soil which are less suitable for sweet potatoes. Of all these root crops, however, sweet potatoes are regarded by many pig farmers as the most useful.

In experiments conducted by the Department of Agriculture and Stock, Belgian field carrots gave results indicating that they are worth a trial. Onions are unsuitable for pig feeding. Jerusalem artichokes are not grown in Queensland to the extent that their importance as a pig food warrants. They are adapted to cultivation in a wide range of soils, although like sweet potatoes, they do best in a deep loamy or sandy soil rich in humus and with plenty of moisture.

E. J. Shelton.

Plate 31.
A maize crop grown for fodder at Charleville.

A CRUSH FOR CATTLE AND HORSES.

A crush for holding cattle or horses should be built on every farm. It costs little and occupies a small area; yet it saves much time and labour when adult stock are to be dehorned, branded, castrated, speyed, drenched, &c. For these operations the animal should be held in a position which allows of no movement.

The ordinary crush can be arranged to accommodate large or small animals. A series of auger holes (½ in. diameter) are bored about 6 inches apart along two rails of convenient height on each side of the crush. The holes should be deep enough to seat a bolt or iron pin firmly. The bolt or pin should stand 4 to 6 inches above the rail. These pins—one on each side—serve as chocks against which a cross rail may be placed. By working the animal right to the front of the crush, the pins and rails may be arranged to prevent any "backing." In a similar manner the width of the crush may be adjusted to prevent lateral movement.

To secure the head of the animal, the "A" shaped bail-type of structure may be made from a double cross rail between which slide vertical poles attached to the base of the crush posts by stout hinges. With such a crush many farm operations usually requiring four men can be done quickly and efficiently by a man and boy.

Plate 32.

"DRY FARMING" IN THE WEST.—A non-irrigated crop of Saccaline Sorghum, near Charleville.

FARM GATES.

Very little in the way of cultural operations is at present possible in many farming and dairying centres of the State, as a result of the adverse weather conditions. Nevertheless, on practically every holding there is quite a lot of work to be done, such as fencing repairs, the making and hanging of gates, the painting of buildings, and the overhauling of machinery, implements, and harness. Some of these jobs can be done during dry weather, and others are better reserved for rainy periods.

It is advisable to give attention to the outsibe jobs first and, of these, the erection and repair of gates is important. It is, indeed, surprising to find so many make-shift gates on the farm when strong light gates can be made or purchased at very reasonable prices.

Of the different types on the market, the wooden gates are the best, as those having a steel pipe frame, if once bent out of shape, are difficult to straighten, whereas a broken rail or two can readily be

replaced. The self-opening types are favoured by some farmers, but these are more expensive and more liable to get out of order than the simpler kind.

Gates should always be swung independent of the fence, on good heavy posts placed 4 feet in the ground, with a sill log in between. The hinges, which should be strong, are generally placed in a vertical line. Occasionally, it is desirable that the foot of a gate should lift when opened, and this can be arranged by placing the lower hinge half an inch off the plumb in the opening direction.

The following materials are required to make a double five-barred bolted gate for a 12-foot opening without any morticing:—

112 running feet of 3-inch by 1-inch or 4-inch by 1-inch timber;

3 lb. of $3\frac{1}{2}$-inch by $\frac{3}{8}$-inch bolts and washers;

2 pairs hook and eye hinges 2 feet by 2 inch by $\frac{5}{16}$ inch.

Butts and heads should be cut 4 feet long, and should be double—that is, placed on each side of the bars. The bottom of the first rail should be 3 inches from the bottom of the upright. The distance between the first and second rails should be 6 inches; between second and third, 6 inches; between third and fourth, 7 inches; and between fourth and fifth, 8 inches. There should be two double stays on either side of rails on each gate running from the bottom of the butt to the top of the head.

When hinges are being placed in position small pieces of 3-inch by 1-inch timber should be inserted against the rails for packing purposes. A sliding piece of 3-inch by 1-inch timber along the third rail between the stay and the head makes an excellent fastener.

Gates are not completed until they have been painted and if the first two coats are given before the gates are put together, a considerable amount of time will be saved.

R. E. Soutter.

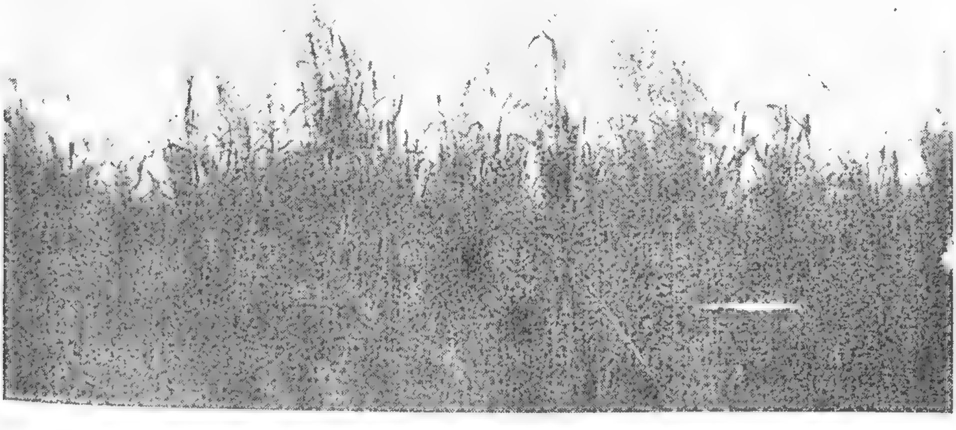


Plate 33.
Sudan grass grown for hay on a property near Charleville.

PHOSPHATIC MANURES.

Three types of inorganic phosphates are available on the Queensland market—superphosphate, Nauru phosphate, and basic phosphate.

Nauru, or rock phosphate, comes from the Nauru and Ocean Islands where it occurs in enormous beds, as tricalcium phosphate, together with various impurities. The rock phosphate is mined and then ground down to very fine dimensions. A good sample would include 87 per cent. tricalcium phosphate, containing 39 per cent. phosphoric acid; 7·5 per cent. other salts and water; 5·5 per cent. impurities.

Superphosphate is manufactured from Nauru phosphate, the latter being first ground and then mixed with approximately an equal amount of sulphuric acid. By this means the insoluble rock phosphate is converted to the water soluble form in superphosphate. Cheaper grades of superphosphate than those marketed in Queensland are available, the prices varying with the water soluble phosphoric acid content of the fertilizer. Australian superphosphate is as high a grade as is sold anywhere.

Superphosphate contains 36 per cent. water soluble phosphate of lime (containing 20·5 per cent. water soluble phosphoric acid); 4 per cent. other phosphates; 48 per cent. other salts; and 12 per cent. moisture and impurities. A little free phosphoric acid is also present.

Purchasers of superphosphate sometimes come across some confusing terms in the trade description. The following are the more important:—

"20·5 per cent. phosphoric acid" is the amount of water soluble phosphoric acid;

"22 per cent. super" indicates the total phosphoric acid in both water soluble and insoluble forms;

"45 per cent. soluble phosphate" is a calculated figure obtained by converting the water soluble phosphoric acid to tricalcic phosphate—the insoluble form in which phosphates occur in Nauru phosphate and bone;

"48 per cent. tricalcic phosphate" describes the total phosphoric acid (soluble and insoluble) in terms of tricalcic phosphate.

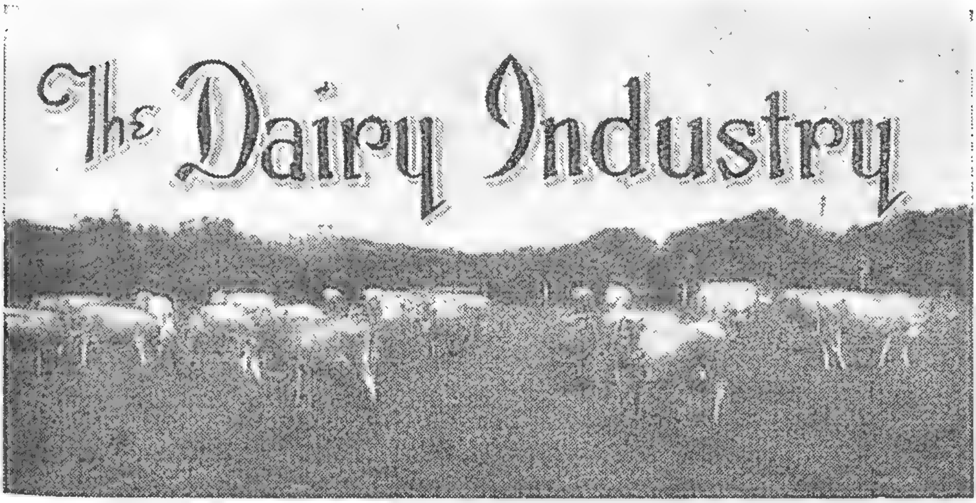
These descriptions may be applied to the superphosphate on the Queensland market, but the only useful figure for comparing different proprietary brands is "per cent. water soluble phosphoric acid." This is what the farmer intends to buy when purchasing superphosphates.

Queensland supplies are obtained from Port Kembla and Cockle Creek in New South Wales.

Basic phosphate is manufactured by mixing superphosphate with lime in varying proportions. The water soluble phosphoric acid is changed to the citrate soluble form.

Basic phosphate has a limited use in Queensland and is not included in mixed fertilizers.

F. B. Coleman.



Profitable Dairying.

MANY farmers consider that the more cows they milk, the more efficient and profitable their dairying activities become. There are, however, a number of other factors which must be considered in relation to dairy farm efficiency.

Matters under the farmers' control include pasture management, the quality of the milk or cream, and the incidence of disease in his herd. Good pasture management requires the introduction of the best grasses, rotational grazing, the conservation of fodder, pasture renovation, and the use of any necessary fertilizers, The quality of the milk or cream is largely controlled by the attention which is given to milking, separating, and storage of the milk on the farm, freedom of the pastures from tainting weeds, and the health of the herd. The incidence of disease in the herd depends to a very large extent on the care and attention given to the animals.

The milking capacity of the herd is dependent on that of the individual cows. Every herd contains animals which are less efficient producers than their companions, and these can only be detected by a regular system of herd testing. Once the unprofitable cows are detected, they should be immediately culled. Their offspring should also be regarded with suspicion, for in all probability they will have inherited undesirable characteristics of their dams. Only the more profitable cows in the herd, as determined by the herd tester, should be retained as breeders.

Farm management and the quality of the herd determine the efficiency of the dairy farm which can best be estimated on the yield of butter fat per acre. Good farm management and a poor herd are just as bad as a good herd and poor management. Good management and a good herd must result in a high yield per acre. Take, for example, the two following cases:—

Farmer A owns 200 acres of land and 50 cows which he bought cheaply at £3 per head from his neighbours. These he allowed to roam at will over his property. By this method he is able to maintain 1 cow on 4 acres of land. From this herd he obtains 7,500 lb of butter fat

(9,000 lb. of commercial butter) per year, equivalent to 150 lb. per cow. With butter fat at 1s. per lb. his gross income is £375. The yield of butter fat per acre is 37½ lb.

Farmer B owns an adjoining 60 acres. He adopted rotational grazing and other desirable practices and was able to maintain 1 cow on 3 acres. He bought 20 selected high-producing animals at £30 per head from which he obtains 6,000 lb. of butter fat per year, or 300 lb. per cow—just double that of his neighbour. His gross income is £300 or £75 less than his neighbour. The yield of butter fat per acre, however, is 100 lb., or nearly three times that of A.

Consideration of the factory returns misled A into believing that he is more efficient than B. An analysis of the finances, however, would show something like the following:—

	A	B
	£	£
Capital invested in land (£15 per acre) ..	3,000	900
Capital invested in buildings and residence ..	900	900
Capital invested in fencing (B subdividing his smaller property)	100	100
Capital invested in cows	150	600
Total capital invested	4,150	2,500
Factory returns total	375	300
Working expenses (A at 5s. acre, B at 10s. acre)	50	30
Net return	325	270
Net return per acre	£1 12 6	£4 10
Net percentage return on invested capital	7·8 p.c.	10·8 p.c.

L. A. Burgess.

PITTED BLUE GRASS.

A Pest in Coastal Pastures.

Pitted blue grass is very common, with a wide distribution in Australia. It is particularly abundant in overstocked pastures in coastal districts, owing to the more palatable species having been eaten out. Stock will eat it, of course, when forced to do so in the absence of other fodders. Pitted blue grass is very abundant in New South Wales and parts of Victoria where, possibly owing to the colder climate, it assumes a reddish tint, and is in consequence known as red leg, or red grass. In Queensland it is frequently known as coastal blue grass.

The improvement of old pastures overrun with this grass is a difficult proposition. In the Southern States, experience has shown that top-dressing with 1 cwt. of superphosphate per acre, preferably using a drill or spreader for the purpose, and the sowing of a small mixture of various clovers is the most satisfactory way of dealing with the pest. Under Queensland conditions, the most satisfactory clovers are white clover, cluster clover, and burr trefoil. About 1 lb. of each should be used per acre, and if desired, about 5 lb. of prairie grass can be added.

C. T. White.

CARE OF MILK UTENSILS ON THE FARM.

Milk as it comes from the average healthy cow contains comparatively few micro-organisms, and these are for the most part inactive in milk. There are many sources from which the bacteria responsible for souring, bad flavours, and other forms of deterioration may gain entrance to milk. Premature souring is very often caused by the use of milk vessels—pails, strainers, coolers, or cans—which, for some reason, are in a state of disrepair. A single utensil which has become worn or bent with continued use, and has developed cracks or crevices, may harbour undesirable bacteria capable of spoiling milk which has been otherwise very carefully produced.

With the cooler weather, summer troubles are apt to be forgotten; but if the cause is not removed, they will crop up again with the first hot spell. A thorough inspection of all milk vessels and equipment is, therefore, desirable, repairs or renewals being made where necessary. The seams of cans and pails should be resoldered if they have opened at all, and dents should be straightened out. Where the defect is more serious, there should be no hesitation in discarding the vessel, as it is only false economy to keep it in use.

No ordinary method of cleaning can dislodge bacteria established in very small crevices for they are well protected, and subsist on the small amount of milk solids left behind whenever the vessel is used. Even steam treatment will not destroy them completely.

Off-flavours, such as tallowy and cardboard taint in both milk and cream, are due to the presence of small amounts of copper and iron, which often come from coolers with defective tinning, or from rusty utensils. These flavours develop rapidly under favourable conditions, such as the exposure of the milk or cream to direct sunlight. They cannot be removed and it is, therefore, necessary to have any worn surfaces retinned as a preventative. Provided no abrasive is used in the preliminary cleaning—a stiff brush will usually remove milk solids—and no strong chemicals are applied, the tinning should have a reasonably long life.

Miss M. J. Griffiths,
Dairy Science Laboratory.

ANTISEPTICS.

Antiseptics are useful in the treatment of a wound and can be applied in two ways:—

1. As a weak solution to wash out the interior of the wound.
2. As dressings impregnated with the antiseptic to absorb any discharge, and prevent the further growth of germs. They also prevent contamination from outside sources.

Stockowners frequently use antiseptics at too great a strength, and do more harm than good. Some tissues are very susceptible to injury and solutions should not, therefore, be used at more than the recommended strength.

Antiseptics are particularly valuable for cleansing the hands before touching a wound, and in concentrated form some can be used to sterilise instruments when boiling water is not available.

After shaving off the hair surrounding a wound, the skin requires treatment with an antiseptic solution before any surgical operation is performed.

In emergencies, a wound should first be cleaned, then treated with an antiseptic, and protected from contamination.

Some common antiseptics are:—

Tincture of iodine—invaluable for immediate application to cuts and scratches.

Methylated spirits—used in undiluted form causes smarting, but has no ill effect on the tissues.

Permanganate of potash (commonly, though not correctly, known as Condy's fluid)—can be added to boiled rain water to make a deep pink antiseptic fluid which is mild in its action.

Boric acid—a saturated solution is made by adding two teaspoonsful to each pint of boiled rain water, and allowing the undissolved material to settle. A useful eye lotion can be prepared by mixing equal parts of the saturated solution and water.

Peroxide of hydrogen—an antiseptic and a deodorant. It is usually used at a 3 per cent. strength, and may be purchased as such. The stronger 30 per cent. solution must first be broken down to a milder form by adding nine parts of water to one of the solution.

—*W. Dixon.*

RATSTAIL OR PARRAMATTA GRASS.

The attention of coastal dairy farmers is drawn to the spread in paspalum and other useful pastures of the weedy ratstail or Parramatta grass. This is a tufted, perennial grass which reaches a height of up to 3 feet. The leaves are narrow, rolled, and wiry, and the seed-stalks are slender and carry a seed-head somewhat resembling a rat's tail.

Ratstail grass is commonly associated with inferior pasture types on second-class grazing country, and its spread into better class pastures is considered to be due to impoverishment of the originally fertile soil underlying those pastures. Since ratstail grass is useful for pasturage only in its very young stages of growth, its replacement of paspalum represents a serious decline in the carrying capacity of the invaded pasture.

Digging or pulling the grass out when it occurs as isolated plants is temporarily effective, but the most efficient means of controlling the spread of the weed is periodical renovation of the pasture with the object of building up the soil fertility and so enabling the paspalum to compete successfully with weed growths.

—*C. W. Winders.*

Dudley Eglinton's Useful Life.

ASTRONOMY AND TECHNICAL EDUCATION.

TO the present generation of Queenslanders, it was by his fame as an astronomer that the late Dudley Eglinton, whose death at his home at Virginia, near Brisbane, took place on the 10th June, was best known. Even before he entered seriously on the study of the stars, however, Mr. Eglinton had laid the people of the State under a debt of gratitude to him by his achievements in the realm of technical education. He also had rendered valuable service to the community as secretary and librarian of the Brisbane School of Arts for 22 years, during which he had been largely responsible for placing the affairs of that institution on a sound foundation.

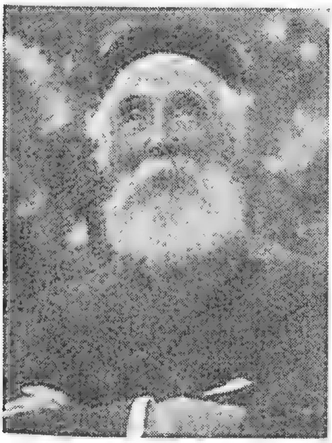


Plate 34.—The Late Dudley Eglinton.

Readers of the Queensland Agricultural Journal will remember him chiefly, with appreciation and gratitude, as the contributor of the monthly astronomical data for Queensland which have been such a valuable feature for a number of years past.

Born at Newcastle-on-Tyne, England, on 12 October, 1850, Dudley Eglinton was a son of Mr. William Eglinton, who had been on the staff of the South-Eastern Railway Company for several years before he decided to bring his family to Australia. After he had been in Queensland for a short period, he was ordained as a Minister of the Church of England. He was the first clergyman to take charge of the Cleveland parish, and subsequently was transferred to Goondiwindi.

After having gained his primary education in private schools, Dudley Eglinton (then aged 16) entered Durham University; but his studies there were terminated 12 months later on his father deciding to come to Australia.

Began as School Teacher.

His first occupation in Queensland was as assistant teacher in the National school at Warwick, under the late Mr. J. A. Canny, who afterwards gained a high reputation as an inspector of schools. Eighteen months later, young Eglinton became a member of the teaching staff at the Church of England School at Toowoomba. He subsequently was a teacher at the Valley primary school, but had only been there for a few months when he applied for, and secured, the secretaryship of the Brisbane School of Arts. That was in 1874. At that time the institution was at the corner of Queen and Creek Streets, where the Queensland National Bank now stands; but in 1878 possession was taken of the site in Ann Street, where the library has since been carried on.

How Technical Education Started.

It was through conversations he had with people who used the library and reading room that Mr. Eglinton realised the need for further educational facilities such as those which night classes and lectures

might afford. It was from this germ of thought that the idea of an elaborate scheme of technical education sprang. It was almost entirely as the outcome of Mr. Eglinton's activities that art classes were started under the tuition of Mr. J. A. Clarke, an artist, and subsequently classes for instruction in book-keeping, shorthand, mathematics, French, German, carpentry, cookery and other subjects, under specially qualified teachers, were arranged for. The scheme was so successful and grew to such dimensions, that Mr. D. R. McConnell, M.A., was appointed director in 1889 and, later again, the Technical College was taken over by the Department of Public Instruction.

Interest in Astronomy.

When, at times, Mr. Eglinton was asked how he first came to be interested in astronomy, he would tell of his good fortune when, as a young teacher in Toowoomba, he had made the acquaintance of Dr. and Mrs. Carr-Boyd, and had been led by the latter to appreciate the beauties of the southern sky. In later years, he availed himself with enthusiasm of opportunities for stellar observations, and for an intensive study of the science of astronomy. Finding this subject increasingly fascinating, Mr. Eglinton devoted much of his spare time to the writing of articles on astronomy for the press, and in the preparation of lectures for delivery before various societies. One of his first articles, in which he discussed the discovery of a new planet, Ceres, and of a group of other minor planets, is dated February, 1897. Long and short articles were published in the press from time to time. Many special articles were written on his favourite subject "The Southern Cross," the first dating back to 1904, while the last was published in this journal, in December, 1936. A comprehensive paper on the Southern Cross and the early history of astronomical activity in Australia was read at the inauguration of the Queensland Astronomical Society, on 1st October, 1927.

In 1912, on the motion of Colonel E. F. Plant, of Brisbane, seconded by Sir Benjamin Stone, who acted on a letter of recommendation from Sir William MacGregor, the then Governor of Queensland, Mr. Eglinton was appointed a Fellow of the Royal Astronomical Society of England, an honour he always greatly prized. Sir Benjamin Stone was a specialist in astronomical photography.

The late Mr. Eglinton was twice married, his second wife being the widow of the late John H. Nicholson (author of "Halek" and other literary works). He leaves three sons one of whom is the Rev. Eric Eglinton (rector of Pialba) and two daughters, Mrs. Essex Evans is a sister of the deceased gentleman.

About 1924 the late Mr. Eglinton had the misfortune to lose his sight, as a result of his continuous use of a telescope in stellar observations. He, however, was enabled to continue his work with the devoted help of his wife; and he was so happy in himself, that those in his company, whilst engaged in animated conversation, were almost prone to forget that he was totally blind.

Law Relating to Bush Fires.

LIABILITY FOR DAMAGE DONE.

A CASE of considerable interest to the man on the land came before the Magistrate's Court in Maryborough on 7th June, when one farmer claimed £200 from another farmer, alleging that the defendant negligently made a fire on his land, and that owing to his negligence, the fire swept on to the plaintiff's property adjoining, doing material damage. The plaintiff claimed that 2 acres of plant cane valued at £92, 2 acres of ratoon cane, valued at £52, 1 acre of pineapples, valued at £60, and 309 standing pine trees, valued at £100, were destroyed—a total value of £304.

In the course of his judgment, Mr. J. A. Murray P.M., gave an interesting exposition of the law respecting the liability of an occupier of land for damage done by a fire which had spread from his property to an adjoining property or properties. Centuries ago, he said, an occupier of land was absolutely liable for damage caused by escape of fire from his land unless he could prove that the escape was due to the act of a stranger or act of God. Then in Queen Anne's reign, a statute was passed which operated to remove from the rule of absolute liability, cases where the origin of a fire could not be shown, that is to say, cases where a fire was accidental within the meaning of that statute. There still remained, however, the question of liability for damage done by fire lighted intentionally but without negligence.

The magistrate quoted an English case, Rylands v. Fletcher, heard in 1868, in which a rule had been laid down that if a person brings a dangerous thing on to his own land he is liable for damage caused if it escaped. Very soon after this decision, it was generally accepted that fire is a dangerous thing within the meaning of the rule, and that if an occupier of land allowed it to escape, he is, unless it were "accidental," liable for any damage it may cause. In recent times, the rule as to absolute liability has been whittled down. The rule that Ryland v. Fletcher does not apply to a "natural user of land" was gradually extended and held to cover "in certain cases" the use of fire.

Among other cases cited by the magistrate was a New South Wales case, Webber and Hazelwood (in 1934), in which the defendant had lit a fire on his land, and burnt off some 100 acres of stubble and during the process a stump was ignited and, a few days later, a high wind caused the fire from the stump to spread to, and do damage on, the plaintiff's land.

Evidence was given that the burning off was an ordinary farming operation conducted in a way in which the majority of farmers in the district burnt off their stubble. The jury gave a verdict that the defendant was not guilty of negligence. On appeal, the High Court held that the defendant was liable, independent of negligence, as it was not an ordinary or natural or reasonable use or employment of land, even if all the farmers in the district took the risk.

The facts found by the magistrate at Maryborough were as follows:—"That on the 28th October 1936, after sundown, defendant who is a farmer . . . , occupying over 100 acres of forest, scrub and cultivated land, lit a fire on his land for the purpose of burning off grass and rubbish. After a time, he left the fire untended

and went home. At 9 p.m. he discovered that the fire had caught a dead mahogany tree which smoulders and burns slowly. Meantime, 20 to 30 acres of his grass had been burnt. He stood by the burning tree for some time, but finally went home again. About mid-day next day, while he was working nearby, a high wind arose causing sparks to fly from the branches and tree which was about 40 feet high. Despite his efforts to control them the sparks were blown across a dry creek nearby and set fire to dry grass on the opposite side. The grass fire got away from him and spread from his land into plaintiff's land causing damages to growing crops and standing timber. At the time the fire was lit the weather had been dry and the grass was in consequence, dry and inflammable.

Mr. Murray held that, in view of the decision of the High Court, in the case of Webber and Hazelwood, it was made clear that "in considering whether any particular user of land is or is not a natural user, the extent of the risk that such user may cause of damage to neighbouring occupiers must be taken into consideration. It remains a question of fact, in each particular case whether or not any particular user is to be regarded as a natural user."

"In this case," continued the magistrate, "the act of defendant in lighting dry grass in open country at a very dry time of the year and leaving it untended and uncontrolled led to the mahogany tree catching alight, and he had difficulty in controlling this tree fire, for, next day when a high wind arose sparks were blown therefrom on to dry grass about a chain or so away and the grass caught fire and got away from the defendant despite his and his wife's valiant efforts.

"I am therefore of the opinion that the defendant's act was not a natural use of the land and that consequently he is absolutely liable for the damage caused quite apart from negligence. Even assuming it was a natural use of land I find the defendant was negligent in allowing the grass fire to set the mahogany tree on fire during his absence. Further, on the following day when he discovered the sparks from the mahogany tree were becoming dangerous he should have obtained assistance to make effective firebreaks on the opposite side of the creek. I am satisfied though that to cut down the tree at that time would have been dangerous to the person and to the spread of the fire to the grass nearby."

Judgment was given for the plaintiff as follows: Plant cane £92; ratoon cane £48; pineapplies £60; standing pine £75; a total of £275 less the £104 abandoned by the plaintiff to bring the case within the jurisdiction of the magistrate's court. The judgment therefore amounted to £171.

LIMING RATOON CROPS.

Farmers frequently learn that their land is in need of liming, just after they have planted their cane, and they are desirous of making an application of this material after the plant cane has been harvested.

In these circumstances, the lime—either burnt or crushed—may be broadcast over the trash, after harvesting. When the trash is burned the ash and lime are cultivated into the surface soil, and given reasonably moist conditions the benefit will readily be apparent on the first ratoon crop.

If this procedure be followed, the application of a fertilizer mixture containing sulphate of ammonia, or of sulphate of ammonia itself, can be made within a month without danger of loss of ammonia from the fertilizer.

H.W.K. in *The Cane Grower's Quarterly Bulletin* (Bur. Sugar Expt. Stns.)

Sugar Levies.

(Abbreviated Notice.)

1937 SEASON.

Regulations under "*The Primary Producers' Organisation and Marketing Acts*, 1926 *to* 1935," have been approved, providing for levies on suppliers of cane to sugar-mills at the following rates for the season 1937 (the figures for 1935 and 1936 are given for comparison purposes:—

Name of Mill.	General Levy by Queensland Canegrowers' Council.	Administrative Levy by District Executive.	Administrative Levy by Mill Suppliers' Committee.	Special Levy by Mill Suppliers' Committee.	Total Levies for 1937.	Total Levies for 1936, given for comparison.	Total Levies for 1935, given for comparison.
	d.	d.	d.	d.	d.	d.	d.
Mossman Central	¾	1¼	..	..	2	2¾	2¾
Hambledon	¾	¼	¼	..	1¼	1⅜	1⅜
Babinda Central	¾	¼	$\frac{3}{16}$	..	1$\frac{3}{16}$	1¼	1⅛
Mulgrave Central	¾	¼	..	..	1	1⅛	1⅛
South Johnstone Central	¾	1½	..	..	2¼	2⅜	2¼
Goondi	¾	1½	¼	..	2½	2⅜	2¼
Mourilyan	¾	1½	..	..	2¼	2¼	2¼
Tully River Central	¾	1¾	..	..	2½	2½	2½
Macknade	¾	½	½	..	1¾	1¾	1⅝
Victoria	¾	½	½	..	1¾	1¾	1⅝
Kalamia	¾	..	¾	¾	2¼	2¼	1¼
Pioneer	¾	..	1	⅝	2⅜	1¾	1¾
Inkerman	¾	..	⅜	..	1⅛	1	1
Invicta	¾	..	1½	..	2¼	1¾	1¾
Proserpine Central	¾	1	..	..	1¾	1¾	1¾
Cattle Creek Central	¾	½	¼	..	1½	1½	1½
Plane Creek Central	¾	½	½	..	1¾	1¾	1¾
Marian Central	¾	½	½	½	2¼	2	2¼
North Eton Central	¾	½	..	..	1¼	1¾	1¾
Pleystowe	¾	½	½	½	2¼	2¼	2
Racecourse Central	¾	½	½	..	1¾	1¾	2¼
Farleigh	¾	½	½	..	1¾	1¾	1¾
Qunaba	¾	¾	¼	..	1¾	1⅛	1¼
Bingera	¾	¾	¼	..	1¾	1½	1¼
Fairymead	¾	¾	½	..	2	1¾	1½
Gin Gin Central	¾	¾	¾	..	2¼	1½	1¾
Millaquin	¾	¾	..	..	1½	1¼	1¼
Isis Central	¾	½	..	..	1¼	1	1¼
Maryborough	¾	¾	..	..	1½	1¼	1½
Mount Bauple Central	¾	¾	..	..	1½	1¼	1½
Moreton Central	¾	..	1	½	2¼	2¼	2½
Rocky Point	¾	..	¾	..	1½	1½	1¾
Eagleby	¾	..	..	..	¾	¾	1

No poll will be taken in respect of the General Levy of ¾d. per ton (first column) for the Queensland Cane Growers' Council, or for the administrative levies by District Executives or Mill Suppliers' Committees (second and third columns).

In the fourth column, the levies on cane supplied to the Kalamia, Pioneer, Marian Central, Pleystowe, and Moreton Central Mills will be used in defraying the costs of employing farmers' representatives at those mills for the current season. In the case of these levies, growers may petition for a poll, and the petition must be signed by at least 100 or 50 per cent. (whichever shall be the less) of the cane suppliers to the five mills concerned.

In addition to the foregoing levies, the undermentioned Mill Suppliers' Committees are empowered to make particular levies on growers within each of the following districts, at the following rates :—

Name of Mill Suppliers' Committee and Mill to which Cane is Supplied.	Description of District upon the Growers wherein Levies will be made and description of Cane upon the Growers whereof Levies will be made.	Amount of Levy per ton of Cane Supplied.	Purposes of Levy.
		d.	
Isis Central ..	Pialba district within the boundaries of the parishes of Urangan, Vernon, and Bingham, county March	1¾	To be used for administrative purposes by Pialba Branch of Isis Central Mill Suppliers' Committee.
Isis Central ..	All cane consigned on the railway by Government trucks from Booyal, Junien, and Marule Sidings on the Dallarnil Railway	¼	To be used for administrative purposes by Booyal Branch of Isis Central Mill Suppliers' Committee.
Mount Bauple Central	Mount Bauple district within the boundaries of the parishes of Gundiah, Tiaro, Gootchie, Curra, and St. Mary	¼	To be used for administrative purposes by Mount Bauple Branch of Mount Bauple Mill Suppliers' Committee.
Mount Bauple Central	Yerra district within the boundaries of the parishes of Gungaloon, Denison, Doongul, Woocoo, and Young	¼	To be used for administrative purposes by Yerra-Mungar district Branch of Mount Bauple Mill Suppliers' Committee.
Maryborough ..	Pialba district within the boundaries of the parishes of Vernon, Urangan, and Bingham, county March	¾	To be used for administrative purposes by Pialba District Branch of Maryborough Mill Suppliers' Committee.
Maryborough ..	Maryborough district within the boundaries of the parishes of Tinana, Maryborough, Bidwell, Elliott, Young, and Walliebum, county March	¼	To be used for administrative purposes by Maryborough District Branch of Maryborough Mill Suppliers' Committee.
Millaquin ..	All cane delivered at Yandaran Siding	½	To be used for administrative purposes by Yandaran Branch of Millaquin Mill Suppliers' Committee.
Racecourse Central	All cane hauled over Silent Grove tramline	2	To defray the costs of employing a farmers' representative of the section of growers concerned at the Racecourse Mill for the current season.
Marian Central ..	All cane loaded at Dow's Creek and Langdon Siding	¾	To be used for insurance and weighbridge maintenance by the Dow's Creek and Langdon Branch of the Marian Central Mill Suppliers Committee.

Growers are given the opportunity of petitioning for a poll to decide whether or not the above levies shall be made. The petition must be signed by at least 100 or 50 per cent. (whichever shall be the less) of the cane suppliers within any of the areas concerned.

All petitions must reach the Secretary for Agriculture and Stock, Department of Agriculture and Stock, Brisbane, on or before the 10th July, 1937.

Full particulars of these Regulations appear in the *Government Gazette* of the 20th May, 1937, or may be obtained on application to the managers of the various sugar-mills in Queensland or to the undersigned—

E. GRAHAM, Under Secretary,
Department of Agriculture and Stock,
Brisbane.

CARE OF STORED HONEY.

If honey is stored in a damp place and not thoroughly sealed up, it will absorb moisture, and if excessive moisture is so taken up the honey is liable to ferment and deteriorate in value. Do not leave the lid off the containers, or leave honey exposed for any length of time during the late autumn and winter months. If kept in a dry place in a sound container honey will keep good for years. It may granulate, but that is not a sign of deterioration, and in such cases it may easily be liquefied by immersion of the container in hot water.

4

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the advanced register of the herd books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Ayrshire Cattle Society, production charts for which were compiled during the month of May, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (OVER 5 YEARS), STANDARD 350 LB.			
Wanulla Bantam III.	E. O. Jeynes, Raceview	12,065·5	509·37	Gay Prince of Bri Bri
	SENIOR 3 (OVER 3½ YEARS), STANDARD 290 LB.			
Sunnyview Gentle 4th	A. E. Vohland, Aubigny	7,898·2	374·675	Jellicoe of Headlands
	SENIOR 2 (OVER 2½ YEARS), STANDARD 250 LB.			
College Wendie	Q.A.H.S. and College, Lawes	7,636·6	332·959	College Robin
	JUNIOR 2 (UNDER 2½ YEARS), STANDARD 230 LB.			
Trevor Hill Polly	Geo. Gwynne, Umbiram	7,955·23	312·138	North Glen, Emblem
Trevor Hill Dove	Geo. Gwynne, Umbiram	6,953·19	282·152	North Glen Emblem
Trevor Hill Mermaid	Geo. Gwynne, Umbiram	6,834·66	277·224	Viscount of Corunna
	JERSEY.			
	JUNIOR 4 (UNDER 4½ YEARS), STANDARD 310 LB.			
Maurfield Golden Lily	F. Maurer, Darra	7,374·7	360·011	Prospect Monty
	SENIOR 2 (OVER 2½ YEARS), STANDARD 250 LB.			
Glenview Hopeful	F. P. Fowler and Sons, Coalstoun Lakes	6,505·1	337·078	Trinity Governor's Hope
	JUNIOR 2 (UNDER 2½ YEARS), STANDARD 230 LB.			
Glenview Tinkelbell	F. P. Fowler and Sons, Coalstoun Lakes	5,806·7	284·167	Trinity Governor's Hope
Oxford Remus Dainty (272 days)	Oxenford Bros., Oxenford	4,444·87	260·608	Overlook Nancy's Remus
	AYRSHIRE.			
	SENIOR 3 (OVER 3½ YEARS), STANDARD 290 LB.			
Myola Jollity	R. M. Anderson, Southbrook	10,994·84	477·464	Longland's Bonny Willie 2nd

The Tropics and Man

Electrical and Other Effects

No. 6.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology, University of Queensland.

IN this initial series of articles I have deliberately dealt with the somewhat technical subjects of temperature, humidity, air-movement, and radiation because these are the important causes of the effects of hot climates upon man. There remain certain minor climatic factors which must be looked at briefly, if we are to leave this branch of tropical study with a properly balanced picture of these causes. With them I shall deal to-day, so that in a future series we can confine our attention more to the man and the results in him of climatic stress and talk less about these technical though important causes.

Electrical Conditions.

We all know the feeling of tension which is experienced before a thunderstorm and the marked relief which is felt afterwards. Those who have experienced the violent dust-storms of the inland plains have noticed the same feelings there. It is quite a popular, and in the absence of any special evidence, a logical belief that it is the accumulation of electrical tension before and its discharge during a thunderstorm which is responsible for the sequence of general feelings. This belief is lent colour by certain individuals who seem to be peculiarly susceptible to these experiences and often predict a storm an appreciable time before the usual weather signs begin to accumulate. Further strength is given to the belief by the demonstration of similar or even greater electrical disturbances in the course of a dust-storm. A party of physicists, investigating the occurrence of thunderstorms in a part of South Africa, where they were very frequent, were very much troubled to find that their recording instrument showed on one occasion a much greater electrical discharge than usually accompanied thunderstorms, in spite of the fact that no storm had been over. Very careful testing showed no fault in the apparatus, and they were left with the conclusion that a dust-storm which had passed over was responsible for the discharge. Unfortunately, Nature did not repeat the experiment for them, and I do not know that anyone else has taken it up. Personally, I find it difficult to believe that such dense dust-clouds travel such distances as they do unless the dust particles are electrically charged.

Doubtful Effect of Ionization.

As I say, there is a popular belief that the electrical state of the atmosphere has a definite effect upon one's feelings of comfort, and certain evidence would fit in satisfactorily with this view. We must remember, however, that electrical disturbances are not the only things going on at the times of these storms. Before a thunderstorm, the air is often still, the temperature is high, and more importantly still the humidity is high. These are all conditions which interfere with loss of heat from the body and produce discomfort. The accumulation of angry

clouds and the hushed voice of nature which precede the storm both have a profound psychological effect, particularly in those people who dislike violent thunderstorms. Such considerations would do no more than sound a warning against pinning one's faith absolutely to the belief in electrical effects, were it not for certain experiments which have been conducted. A number of subjects were allowed to breath air which, without their knowing, was charged with electrical particles of one or other kind. In the majority of normal people the breathing of such air had no definite effect upon sensation or upon a number of other bodily functions. I myself sat as a subject upon one occasion, and the only time I experienced any change in sensation was when the plant, unknown to me, was not working and I was breathing ordinary every-day air.

While normal people were not affected in these experiments, people of the "rheumatic" type and people with disturbance of blood pressure often did experience some alteration of sensation and showed other evidence of being affected by the electrical charges. This matter is still being investigated, and the results should be of interest. As the matter stands at present, the importance of electrical changes to perfectly normal people appears to be small, but to certain susceptible people they may be of some importance.

Barometric Pressure.

It is quite definite, of course, that when the barometric pressure is markedly lowered, as in climbing high mountains, people suffer from lack of oxygen. It is equally true that a marked increase in pressure (over two atmospheres) also affects the body, not while it is on, but if it is suddenly released. These effects are seen in divers and in compressed air workers. It is highly doubtful, however, whether the normal fluctuations which occur at moderate heights in different parts of the world and at different times have any effect upon human welfare. An authority in tropical medicine once solemnly stated that the lowered barometric pressure in the tropics (itself a doubtful statement) meant that tropical dwellers must suffer from lack of oxygen. This statement was repeated by an even greater authority in tropical medicine. Any second-year medical student could tell you why this statement cannot possibly be true—which only shows how authorities can make bad slips when off their beaten track.

Chemical Effects.

In the days before more exact knowledge was possible, it was the fashion to ascribe puzzling medical conditions to vague atmospheric influences and "miasmata." There was a feeling that in certain areas there were chemical or even more mysterious vapours abroad in the air which left death and ill-health in their wake. These conditions have largely been tracked down to much more prosaic causes such as mosquitoes, germs, and the like, but from time to time the chemical theory is resurrected to explain, or rather dispose of some difficulty in understanding the occurrences of disease. As a matter of fact, the chemical composition of the air all over the world is remarkably constant, apart from certain very localised and well-known instances, such as the accumulation of carbon-dioxide gas in lime-stone caves. There is certainly no evidence to associate chemical changes in the air with tropical conditions.

Mechanical Effects.

The purely mechanical effects of wind and rain are well seen in the rugged countenance of the all-weathers man. These are more beneficial than otherwise, although sometimes in blondes they may assist radiation in producing skin cancers. Of more importance is the abrasive effect of sand and dust. This probably accounts for the frequent occurrence of small fibrous growths on the eye-ball in dusty climates. These "pterygia" or "pingueculae" start from the corner of the eye and grow very slowly across. Occasionally they grow large enough to require removal—a fairly simple procedure. They are frequently confused by well-meaning advisers with cataract, but this is an unnecessary and lamentable blunder which has caused considerable distress to many people. Another effect of dust is to irritate the lining of the nose, and, with the swelling produced by heat radiations, to produce blockage of the nasal passages. This seems to be more noticeable in newcomers than in residents.

WORMS IN POULTRY.

During the rearing of birds about to commence their first season of production, diseases such as coccidiosis, bacillary, white diarrhœa and roup will have taken their toll. These diseases are spectacular in their onset and the symptoms manifested and the mortalities experienced have compelled the poultry farmer to undertake control measures in order to mimimise his losses as much as possible.

In many instances, however, worm infestation has been overlooked. The effects of worm infestation are usually insidious in nature, and being accumulative do not attract attention until the birds are seriously affected. Such effects include failure to make normal growth and even loss of weight, loss of appetite and activity, dull, ruffled plumage, and a paleness of the comb and shanks. The mortality, especially among young birds, may be serious. More important still young pullets, while maintaining a ravenous appetite and being apparently in fair health, are not producing their normal quota of eggs.

Of the various worms which infest poultry one of the most important is the large roundworm, which grows up to 4 or 5 inches in length, and is found in the intestine. Where the farmer pays careful attention to sanitation and cleanliness this and other worms rarely become dangerous for, by the regular removal of droppings and the adoption of other measures which promote cleanliness, the source of infestation is removed. Prevention of infestation is most important in the control of parasitic worms. There are, however, certain drugs which may be employed to remove the worms from the birds, and if treatment is employed regularly the infestation should be of no great importance. Treatment of poultry for worms may be undertaken either by mixing certain drugs with the mash (flock treatment), or else by giving the drug to each individual bird (individual treatment).

Flock Treatment.—Flock treatment can be applied with success only when the birds are kept under intensive or semi-intensive conditions. The procedure is to mix nicotine sulphate with the mash at the rate of .5 cubic centimetre of nicotine sulphate for every 1 lb. of dry mash. The amount of nicotine sulphate required is incorporated with just sufficient water so that when mixed the mash is flakey. About 1 part of nicotine sulphate to 400 parts of water is usually adequate. The mixing should be thorough so that no lumps remain. This treated mash is mixed fresh daily and fed continuously for four days.

Individual Treatment.—The best drug to use for individual treatment is carbon tetrachloride. This may be given in capsules or by means of a syringe and rubber tubing. The birds are starved overnight and treated next morning. They may be fed immediately after treatment. The doses range from .5 cubic centimetre to 2 cubic centimetres, depending on the size of the bird. If the syringe is used great care must be taken to avoid delivering the drug into the windpipe, which would cause instant death. Before undertaking this treatment farmers should apply to the Animal Health Station, Yeerongpilly, for further details.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Madagascar Plum. Worm Seed.

K.R.E.B. (Marian)—

Your specimen is the Governor plum or Madagascar plum, *Flacourtia Ramontchi,* a native of Madagascar, but cultivated widely in tropical and sub-tropical countries. It is an excellent, edible plum; the male and female trees are distinct, the females, of course, only bearing fruit. The Burdekin plum is a totally different plant, a native tree, common in the scrubs from the Burnett District northwards.

The weed is *Chenopodium ambrosioides,* the worm seed. The seed of this plant and an allied species is the source of oil of chenopodium, largely used as a worm expellent. It is not known to be poisonous or harmful in any way, but we do not remember ever having seen stock eat it. Its extraordinarily strong odour would probably prevent them from touching it.

Bull-head Burr. Khaki Weed. "Fat Hen."

R.A. (Nanango)—

(1) *Tribulus terrestris,* bull-head burr. This plant is very widely spread over the warmer temperate regions of the world, and is a moderately common weed in Queensland. It is particularly abundant on some of the Downs country of the Central West. It occurs in South Africa where it is accused of causing a disease in sheep, known as big-head, or yellow-head. No trouble, so far as we can ascertain, has been caused by the plant in Australia.

(2) *Alternanthera repens,* khaki weed, a native of tropical America, and now widely spread as a weed in most warm temperate countries. It is supposed to have been introduced into Australia from South Africa about the time of the Boer War.

(3) *Chenopodium album,* fat hen or goose foot, a very common farm weed in Queensland, and not known to possess any poisonous or harmful properties.

One of the Sorghums.

T.P. (Maleny)—

Your specimen is not Johnson grass, but a very closely allied sorghum, *Sorghum verticilliflorum,* a native of Africa, now very common in Queensland, and we think as common, if not commoner, than the true Johnson grass. It is frequently seen in cultivation lands and similar places where the ground has been disturbed. It grows very vigorous, and is easier to eradicate than Johnson grass, as it does not form the white, underground stems that Johnson grass does. Ordinary digging out will soon get rid of it. Like other sorghums, it contains a prussic-acid-yielding glucoside; in fact, it is one of the worst offenders in this respect, and caution must, therefore, be exercised in feeding stock with it.

"Scrub Panicum."

"Inquirer" (Ridgelands)—

The specimen represents *Setaria australiensis,* commonly called in Queensland, the scrub panicum, a native grass, frequently seen around scrub clearings, and along scrub tracks. It is generally regarded for such places as quite good fodder, but we think it is hardly worth cultivating, for where it should grow, better fodders, such as giant setaria or Manchurian millet, which are very closely allied to it, would grow equally as well. Seed of the scrub panicum is not stocked by nurserymen, but the giant setaria is obtainable through commercial channels at a fairly cheap rate.

Plants from the Murgon District Identified.

C.G. (Moffatdale Project Club, Murgon)—

1. *Arundinella nepalensis*—a common grass on forested hillsides in many parts of coastal Queensland. It is also very common in the Burnett district. We have not heard a local name given to it. It is not usually regarded as of much value as a fodder.
2. *Cyperus fulvus,* a sedge, not a true grass. The sedges, on the whole, are not regarded as having the same value as true grasses.
3. *Setaria glauca,* pigeon grass—a useful grass, particularly for wet, low-lying paddocks. It is also commonly seen as a weed of cultivation.
4. *Bothriochloa intermedia,* forest blue grass—the commonest native grass in many parts of the Burnett district and Callide Valley.
5. *Sporobolus elongatus,* rat's tail grass—not generally regarded as of much value as a fodder.
6. *Bothriochloa decipiens*—bitter blue grass, or pitted blue grass. The latter name comes from a small pit that can be seen in the spikelet. This grass has over-run many paddocks to the exclusion of other species, owing to better sorts having been eaten out. Stock will eat it, but do not care for it when other feed is available.
7. *Chloris ventricosa*—a native chloris or windmill grass, generally regarded as a good fodder. It sometimes comes up very thickly in cleared brigalow country, or cleared vinescrub country.
8. *Paspalum dilatatum,* common paspalum.
9. *Eleusine indica,* crowfoot grass—a very common grass, widely spread over the warmer regions of the world. In Queensland, it occurs mostly either as a weed of cultivation or where the ground has been disturbed. It is moderately palatable to stock, but, like sorghum and some other grasses, contains a prussic-acid-yielding glucocide; very little trouble has been experienced with it in Queensland.
10. *Eragrostis leptostachya*—paddock love grass. The love grasses are of only secondary value as fodders, but are rather useful grasses in mixed native pasture.
11. *Digitaria marginata,* summer grass—occurs mostly as a weed of cultivation or where the ground has been disturbed. It is quite palatable to stock.
12. *Digitaria divaricatissima*—a roly-poly grass.
13. *Pennisetum alopecuroides*—swamp foxtail.
14. *Eriochloa* sp.—early spring grass. We have several species of Eriochloa in Queensland, and they all go under the name of early spring grass. They are very palatable. The vernacular name is not particularly appropriate, as they are no earlier than many other grasses that come up after early spring rains.
15. Specimen damaged, but looks like *Cynodon dactylon,* the common couch grass.
16. *Eragrostis cilianensis*—stink grass. This grass is a native of Southern Europe, and in Queensland occurs mostly as a weed of cultivation. It is not particuarly palatable to stock. The name stink grass arises from the number of glands along the leaf edge which give off a peculiar, and not altogether unpleasant, odour.
17. *Aristida glumaris*—a species of wire grass or three-pronged spear grass. The wire grasses or spear grasses, on the whole, are of very poor quality as fodder.
18. *Chloris virgata,* feather top or woolly top Rhodes grass—a very luscious-looking grass, very common as a weed of cultivation and in places where the ground has been disturbed. In spite of its appearance, stock do not seem to take readily to it, although they will eat it, we have been told, in the form of hay.

Purple Datura.

Q.S.Q. (Mitchell)—

The specimen represents *Datura cornucopa,* the "horn of plenty," or purple datura, a plant, we believe, of garden origin. It is very closely allied to the common stramonium or thorn apple, naturalised along watercourses on the Darling Downs and in the Maranoa district. This common species is frequently known as castor oil, although the true castor oil, naturalised in coastal Queensland, is a different plant.

Practically all species of *datura* are poisonous in all parts, the seeds being the most virosent. The one you sent is frequently cultivated as a garden subject, and we have never known it to escape, and become a bad weed-pest. It contains, however, possibilities in that respect.

Elephant Grass.

A.W.T. (Chermside)—

Elephant grass is still cultivated to some extent in coastal Queensland, but has gone out of favour somewhat, as it is not so palatable as other fodders. It also is inclined, if left standing, to grow to rather a hard cane. On this account, the grass should be kept cut back, to not more than six feet high. If preferred, it can be grazed, and stock under these conditions, usually eat it well down. It is very easily propagated, either by division, or cuttings, If propagated by cuttings, two or three nodes of the hard cane part should be used, and two nodes or joints placed in the ground. If preferred, they can be planted horizontally, like sugar-cane. Grown from division, the plants should be cut well back, almost to the ground, and the stool divided into individual cuttings.

The grass is fairly nutritious, and we think worth growing, if kept treated in the way recommended. If the stock are turned on to it, when it is very high, they will eat it back to the cane portion, and this will then send out tufts along the edge, which are quite palatable.

Common Weeds in North Queensland.

Inquirer (Townsville)—

The specimens collected at the railway trucking yard at Bambaroo have been determined as follows:—

1. *Flemingia parviflora*—a native legume, very common in the pastures of North Queensland.
2. *Urena lobata*—one of several weeds known in the North as Chinese burr.
3. *Sida acuta*—popularly called *Sida retusa* in the North.
4. *Capsicum fastigiatum* Chili. This species is the main source of cayenne pepper.
5. *Sida cordifolia*—flannel weed.
6. *Gomphrena decumbens*—a plant of the Amaranth family, a very common weed in North Queensland, but for which we have not heard a local name.
7. *Hyptis suaveolens*—one of the several plants of the family *Labiateae*, known in North Queensland as "mint."
8. *Erechthites quadridentata*—a common weed of the family *Compositeae*, for which we have not heard a common name.
9. Grass—seed-heads would be required to identify.
10. *Xanthium pungens*—noogoora burr. The noogoora burr is poisonous only in the cotyledon stage. In the stage of the present specimen, as far as we know, it is quite harmless.
11. *Stylosanthes sundaica*—Townsville lucerne.
12. *Bothryochloa intermedia*—a species of blue grass.
13. *Acanthospermum hispidum*—star burr.
14. *Physalis minima*—wild Cape gooseberry.

All are very common weeds throughout the whole of North Queensland, particularly in the coastal country. None of them is known to cause any trouble to stock, as far as we know.

Specimens from Tamborine Mountain Identified.

G.A. (Tamborine)—

(1) *Marsdenia rostrata.* Milk vine: this plant is poisonous to stock.

(2) *Solanum campanulatum.* A prickly species of Solanum very common as a secondary growth on Tamborine Mountain and other places in South-eastern Queensland. We have never heard of stock eating it to any extent, although parts of most solanums are harmful.

(3) *Stephania hernandiaefolia.* Tape vine, a plant poisonous to stock.

(4) *Solanum stelligerum.* A species of Solanum or Potato Bush very common as a secondary growth on Tamborine Mountain and coastal Queensland.

(5) *Vitis clematidea*, a wild grape vine not known to to be poisonous or harmful in any way to stock.

If you are losing stock from poisonous plants we are inclined to regard number (1) as the most likely cause of the trouble.

Rice Grass.

C.F.R. (Caloundra)—

It is rather difficult to determine grasses correctly in the absence of seed-heads, but we think the one you sent is *Leersia hexandra*, a rice grass, generally regarded as an excellent fodder for wet, swampy situations.

Some Bush Flowers.

E.J.S. (Kalbar)—

(1) *Cynoglossum suaveolens.*

(2) This looks like the same as No. 1, but in very young flower. This plant is frequently known as Native Forget-me-not.

(3) *Pimelea pauciflora*, sometimes called scrub kurrajong, probably on account of the fibrous nature of the bark. It has been proved by feeding tests to be poisonous to stock, but stock rarely eat it in sufficient quantities to cause trouble.

(4) *Cynoglossum latifolium.*

(5A) and (5B) *Pimelea pauciflora.*

(6) *Synoum glandulosum*, a tree of rather irregular growth, commonly called scentless rose bush.

(7) *Drimys dipetala*, sometimes called pepper bush.

(8) *Bothrychium ternatum*, parsley fern.

(9) *Helipterum anthemoides.*

(10) *Peperomia reflexa.*

(11) *Cadellia monostylis.* This plant was called *Guilfoylia monostylis* by Mueller, and now most botanists keep his genus distinct from Cadellia. In this, we think they are right.

(12) *Liparis reflexa.*

(13) *Psychotria loniceroides.*

(14) Are you sure the leaves are correctly matched with your description of the flower? Your description of the flower fits almost exactly *Tarretia*, either *argyrodendron* or *T. actinophylla.* The former is commonly known as hickory, crow's foot elm, or booyong, the latter sometimes by similar names, or as black jack. Both occur in the Cunningham's Gap scrub. The leaves, however, do not seem to belong here, and we cannot place them satisfactorily. It is often very hard to match leaves on the ground with those on the tops of the trees.

Plants from the Mid-West Identified.

C.H.D. (Roma)—

(1) *Glycine tabacina.* Glycine peas are very common legumes in the average native mixed pasture, both in coastal Queensland and further inland. The actual species are not very well defined, but we should say they should have much the same food value, and are quite useful herbs.

(2) *Desmodium campylocaulon* or tick trefoil, peculiar to the inland parts of Queensland.

(3) *Crotalaria dissitiflora*, a species of rattle pod.

(4) *Glycine tomentosa.*

(5) *Dichanthium sericeum*, blue grass.

(6) *Dichanthium sp.* This may be a form of No. 5, but the genus is at present under review, and in many cases, we cannot give specific names until our material has been revised by Mr. C. E. Hubbard, of the Royal Botanic Gardens, Kew, England, who is monographing the group.

(7) A form of *Bothriochloa intermedia.* This differs from the ordinary intermedia in having a very much more branched inflorescence, but otherwise seems the same. It is quite common in Queensland, but as yet, has not received a distinctive varietal or specific name.

Button Grass.

F.McC. (Mundubbera)—

Your specimen represents the button grass, *Dactyloctenium radulans*, a very common grass in Western Queensland, but not so often seen nearer the coast. It is a grass that comes up very rapidly with summer rains and soon dries off. Like Flinders grass, however, when it dries off, it is generally regarded as a valuable fodder, and a good standing hay. It is one of the recognised important sheep grasses of the Western Downs.

Grasses, Millets and Sedges.

A.MacK. (Brookfield)—

(1) *Setaria geniculata* var. breviseta.

(2) *Setaria glauca.* Both 1 and 2 are sometimes called pigeon grass, also native setaria or wild millet, though this last name is applied to a number of grasses in Queensland. They are quite good grasses, though, usually speaking, they prefer old cultivation lands or rather damp situations. They are not so frequently seen in the ordinary pasture.

(3) A form of *Bothriochloa intermedia,* forest blue grass.

(4) *Kyllinga cylindrica,* Mullumbimby couch, a sedge, not a true grass. The sedges are separated from the true grasses on several botanical characters. They are not generally regarded as having the same fodder value as grasses.

(5) *Bothriochloa intermedia.*

(6) *Sporobolus Berteroanus,* Parramatta grass.

(7) *Cyperus gracilis,* a sedge. (See remarks on No. 4.)

(8) *Eleusine indica,* crow's foot grass. This grass is very widely spread over the warm temperate regions of the world. In Queensland, it mostly occurs as a weed of cultivation. Like young sorghum and some other plants, it contains a prussic-acid-yielding glucoside but fatalities from it in Queensland are exceedingly rare.

(9) *Brachiaria foliosa,* leafy panic grass, generally regarded as an excellent fodder.

(10) *Sida rhombifolia,* most commonly known as sida retusa, one of the commonest farm weeds in Queensland.

(11) *Alstonia constricta,* native cinchona, native quinine, or bitter bark. The bark of this tree is official in the British pharmacopœia, but the demand for it is very small, and the price low. It is used as a tonic.

(12) *Wickstroemia indica,* tie bush. The local name comes from the fact that the bark is very flexible, and was used as a source of fibre by the aborigines. On many occasions, this plant has been reported to us as poisonous to stock. Feeding experiments carried out on the leaves at Yeerongpilly some years ago gave negative results. The animals fed on the plant were very emaciated at the end of a fortnight's feeding, with the faeces stained with blood, but recovered when put on to ordinary food. A couple of years ago, some berries of this were received which, it was said, had caused the death of a child at Nambour. Fed to guinea-pigs at Yeerongpilly, they produced death in a very short time. It was seen, therefore, that the plant is most dangerous when in berry.

(13) *Mallotus cloaxyloides,* a small tree, very common as a scrub regrowth in South-eastern Queensland. We have not heard a local name given to it.

(14) *Elaeocarpus obovatus,* pigeon berry, or blue berry ash, a very common tree along creek-sides in Southern Queensland. It bears white flowers in very great abundance during the late spring months, and these are assiduously worked by bees.

Stramonium or Thorn Apple.

The Shire Clerk (Rosewood)—

The specimen forwarded is the Stramonium or thorn apple, *Datura stramonium,* a very common weed in cultivation and along creek banks in Queensland. It is a very poisonous plant, but stock usually avoid it in the growing state. The only trouble that we have experienced with it has been when it has been cut with a crop, chaffed, and the subsequent chaff fed to working horses or chaff-fed cows. The leaves are used for making cigarettes for smoking to give relief in asthma.

White Cedar Berries.

A.H. (Laidley)—

The specimens forwarded represent *Melia dubia* (white cedar). The fleshy part of the berries of white cedar is undoubtedly poisonous to all classes of stock, pigs being particularly susceptible. Experimental work has proved that the bark and flowers are also poisonous. So far as we know, however, the leaves have not been found to produce death in animals that feed on them. Your enquiry has been passed on to Dr. W. R. Seddon, Veterinary Adviser, who has carried out some investigations on this tree.

Grasses Identified.

N.R.A. (Kabra, via Rockhampton)—

(1) *Bothriochloa decipiens*, sometimes called bitter blue grass, or coastal blue grass. It is very widely spread in Queensland, and on the whole, is of only secondary value as a fodder. It is exceedingly common now in some places, the more palatable native grasses having been eaten out.

(2) *Heteropogon contortus*, bunched spear grass.

(3) *Eragrostis leptostachya*, paddock love grass.

(4) *Enneapogon avenaceus*, white heads.

(5) *Eleusine indica*, crowfoot grass. This grass is very widely spread over the warmer regions of the world. In Queensland, it mostly occurs as a weed of cultivation, or in places where the ground has been disturbed. It has a very firm hold of the soil, and is, on this account, sometimes called "Holdfast." It is moderately palatable, but contains a prussic-acid-yielding glucoside. Nevertheless, there are very few records of its having been harmful to stock in Queensland.

(6) *Bothriochloa decipiens.*

(7) *Cyperus bifax*, a sedge. The sedges are very closely allied to the true grasses, but on the whole, have not the same fodder value. "The Principles of Botany for Queensland Farmers" which has been running as a series of articles in the Queensland Agricultural Journal, will soon be published in book form.

(8) *Eragrostis cilianensis*, stink grass. This is very widely distributed over the warmer regions of the world. In Queensland, it mostly occurs as a weed of cultivation. The name "stink grass" arises from the peculiar, but not altogether unpleasant odour, given off by the leaves when crushed. So far as our experience goes, stock do not take very readily to the grass, though we have been told that horses, when being worked in cultivation, will eat it at every opportunity. This, however, is hardly a normal test. They may eat it perhaps, in the form of hay, as it often occurs with grasses of this type.

(9) *Sida cordifolia*, flannel weed.

(10) *Dactyloctenium aegyptium*, button grass.

(11) *Chloris barbata*, purple top Rhodes grass.

(12) *Indigofera hirsuta*, hairy indigo.

(13) *Acanthospermum hispidum*, star burr.

Aggressive Weed Pests.

P.McM. (Ballandean)—

(1) *Ajuga australis*, Australian bugle, a native plant, fairly common in some parts in the forest pasture, and occasionally seen as a weed of cultivation. So far as we know, it has not established itself anywhere as a very aggressive weed-pest in cultivated land.

(2) *Verbena bonariensis*, purple top, a native of South America, now naturalized as a weed in many warm countries. It is a very objectionable weed in Queensland and New South Wales, aggressive, though on the whole, not particularly difficult to eradicate in small areas.

These are the names corresponding to the numbers on your specimens, though from your description, No. 1 is a vigorous upright grower, and No. 2, a low stunted plant. This seems to indicate that your specimen numbers and notes do not correspond.

Oat and Barley Grass.

J.T. (Charleville)—

(1) *Panicum decompositum*, barley grass, also commonly called native millet, though this latter local name is given to a number of grasses in Queensland. This grass is very common in many parts of Western Queensland, and provides a fair bulk of forage. Seeds were used by the aborigines in the early days as a source of grain.

(2) *Astrebla lappacea*, curly Mitchell grass, probably the best of the Mitchells.

(3) *Astrebla elymoides*, hoop Mitchell.

(4) *Themeda avenaceus*, tall oat grass; makes a good bulk of leafy bottom.

(5) *Themeda australis*, kangaroo grass.

Identification of Grasses.

J.S. (Eidsvold)—

(1) *Dichanthium sp.* one of the blue grasses. Most of the blue grasses are quite good fodders and play an important part in the mixed native pasture. They are not particularly drought-resistant, and do not stand up to heavy stocking.

(2) *Chloris divaricata,* one of the native chloris, or windmill grasses, but makes a fair bottom for sheep.

(3) *Bothriochloa intermedia,* forest blue grass.

(4) *Aristida sp.,* a wire grass or 3-pronged spear grass. We do not know of any way of getting rid of this plant. Species of wire grass or 3-pronged spear grass are very much inclined to over-run much of the sandy land in many parts of Queensland. In other places, they are very common on hillsides, and spread rapidly down, eating out all the better class of fodders. They are drought-resistant, and unpalatable.

(5) *Chloris gayana,* Rhodes grass.

(6) *Digitaria Brownei,* a fairly common grass in much of the sandy lands of Queensland. It is not known to have any particular virtues, but is probably quite useful in the mixed native pasture on such country.

(7) *Themeda avenaceus,* tall oat grass.

(8) *Tragus racemosus,* small burr grass.

(9) *Heteropogon contortus,* Bunch-spear grass, very palatable for stock in its younger stage, but soon becomes very harsh, and inclined to overrun much hillside country.

(10) *Eragrostis elongata,* a love grass.

(11) *Calotis lappulacea,* burr daisy. This and other species of calotis are commonly called bindy-eyes but this local name is now applied very commonly in Queensland to a number of burr plants.

(12) *Siegesbeckia orientalis,* commonly called farmer's lice, a very common weed of cultivation, sometimes seen on hillside pastures. It is of no particular consequence, and would not be very aggressive, we should think, under your conditions.

(13) *Arundinella nepalensis,* a reedy grass, very common on hillsides in Queensland. It is too coarse to be of much value as a fodder, but is not an aggressive species in the same way as the aristidas or wire grasses.

(14) *Malvastrum spicatum,* a very common weed of the mallow family.

(15) *Grewia latifolia,* a moderately common plant in Queensland, particularly on hillside country. In North Queensland an allied species is used as a cure for diarrhœa and dysentery, it is said, with very good results. Probably the leaves of the present species would have much the same effect. It is not known to possess any poisonous or harmful properties, but we have never seen cattle eat it, at least to any extent.

Bottle Tree Caustic.

Inquirer (Mitchell)—

Your specimen is the bottle tree caustic, *Euphorbia eremophila,* a very common weed in many parts of Australia, and stretching in Queensland from the coast right on the sea-beach to the far west. It is generally regarded as poisonous to stock, particularly sheep, though ordinary paddock stock do not seem to eat the plant to any extent, and most of the trouble from it has been with travelling stock, or freshly untrucked sheep. The symptoms described are similar to those of the ordinary scrub caustic (*Euphorbia Drummondii*). The head and neck of affected sheep swell very considerably, and if the swelling is pierced an amber-coloured fluid exudes, and the life of the sheep may be saved.

Feather Top Grass.

J.H.F. (Columboola)—

Your specimen is *Chloris virgata,* commonly known as feather top, or woolly top Rhodes grass. This grass is very widely spread over the tropical and subtropical regions of the world, and is quite common in many parts of Queensland, particularly as a weed of cultivation. It is very common in the lucerne-growing areas of the Lockyer Valley, and is said to have seriously decreased the earning capacity of some of the lucerne fields. It is a luscious-looking grass, but stock do not take very readily to it, though they are said to eat it freely in the form of hay. It is barely worth cultivating, as, on the whole, where it grows Rhodes grass can be grown equally well, and is a better fodder.

Annatto and Clitorus: Ornamental Shrubs.

T.H. (Maclean, N.S.W.)—

Your specimen represents *Bixa Orellana*, the Annatto, a native of tropical America, but now widely cultivated as an ornamental shrub in many tropical and sub-tropical countries. The seeds are contained in a prickly pod, and the red covering that surrounds them is exported from some countries for the purpose of colouring butters and cheeses. Annatto is particularly used for this purpose in Continental Europe, where a demand for a highly-coloured butter or cheese exists.

We do not know where you could obtain seeds of *Clitorus*. They do not seem to be regularly stocked by seedsmen here. The plant is quite naturalized about Townsville, and is seen everywhere on the hills about the town. Perhaps the Curator, Botanic Gardens, Townsville, might be able to supply you with some. We occasionally have a few on hand, and will remember your request.

Grasses from the Mid-west Named.

A.M.H. (Chinchilla)—

1. *Chloris virgata*—feather top or woolly top Rhodes grass. This grass is very widely spread through Queensland, and mostly occurs as a weed of cultivation or where the ground has been disturbed. Although rather luscious-looking, our experience has been, on the whole, that stock do not take to it very readily, although we are told they eat it freely enough in the form of hay.

2. *Echinochloa colona*—barnyard millet or wild millet. This grass is very common in parts of Queensland, and occurs mostly either as a weed of cultivation or in damp places. It is an excellent pasture, and is very closely allied to such well-known cultivated plants as white panicum and Japanese millet.

3. *Eleusine indica*—crowfoot grass, a very common grass in Queensland, mostly occurring as a weed of cultivation.

4. *Rynchelytrum repens*—red Natal grass. This grass is now very widely distributed in Queensland, and occurs mostly either in cultivation lands or where the ground has been disturbed; in some places it has extended into the ordinary pasture. Reports on its fodder value vary, but, on the whole, it is of only secondary value. It is a very common weed on the fruit farms of coastal Queensland, and by itself, and with other fodders, has been found to make excellent chop-chop for working horses.

A CONVENIENT AND SIMPLE FIRE-STICK.

The following idea for a cheap and effective fire-stick comes from a northern canegrower:—

A 3 to 4-foot length of ½-inch or ¾-inch galvanized piping is plugged at one end with a piece of suitable cloth, to serve as a wick. This may be attached to a length of wire, like a rifle "pull-through," and is so packed that kerosene poured into the pipe just leaks slowly through. The wick is lighted, and the operator walks along the border of the field dropping flame on the trash.

One bottle of kerosene will suffice to burn several acres of trash. It may be used also on weeds and rubbish generally, and its lightness makes it a handy weapon for the reburning of cane tops which have been raked into rows, and which would probably serve to reinfect neighbouring crops with borers were they not destroyed by fire.

E.H.F. in *The Cane Growers' Quarterly Bulletin* (Bur. Sugar Expt. Stations).

General Notes

Staff Changes and Appointments.

Messrs. F. C. J. Jorss, H. Lambert, and R. J. Rollston have been appointed assistant inspecting cane testers for the forthcoming sugar season, with headquarters at Cairns, Mackay, and Bundaberg, respectively.

List of police officers appointed to act also as inspectors of slaughterhouses as from the 8th May, 1937: Sergeant T. G. Long (Redcliffe), Sergeant J. R. Meade (Cooktown), Sergeant J. Rinaldi (Mossman), Constable A. Cox (Yelarbon), and Constable R. V. Walker (Rosedale).

Mr. D. A. Bacon has been appointed an inspector of dairies, stock, and slaughterhouses as from the 17th May.

Additions to the list of honorary rangers under the Animals and Birds Acts:—Messrs. S. R. Prout (Finch Hatton), C. W. Davidson (Carmila), C. A. Atherton (Koumala), F. A. Atherton (Koumala), S. A. Lilliendal (Koumala), J. C. Rasmussen (Mount Convenient, Sarina), E. S. Daly (Ilbilbie) J. Lawrie (West Plane Creek, Sarina), and E. J. Walsh (Shinfield, Sarina).

Mr. L. H. Roles has been appointed chairman of the Isis Local Sugar Cane Prices Board, vice Mr. V. J. Anderson, transferred.

Mr. N. J. King, A.A.C.I., soils survey officer, Bureau of Sugar Experiment Stations, Bundaberg, has been appointed chemist-in-charge, Sugar Experiment Station, Bundaberg.

Messrs. A. J. Hooper (Tourist Officer, Cairns) and M. P. Staunton (Assistant Tourist Officer, Cairns) have been appointed honorary rangers under the Animals and Birds Acts and the Native Plants Protection Act as from the 1st May, 1937.

The following persons have been appointed cane testers for the forthcoming sugar season at the mills indicated—G. E. Becker (Mulgrave), Miss D. Bowder (Marian), T. Breen (Proserpine), T. P. Brown (Mossman), J. Casey (Tully), L. Chadwick (Inkerman), Miss E. Christsen (Mourilyan), L. G. F. Holbach (South Johnstone), C. H. Humphreys (Cattle Creek), C. H. Jorgensen (Kalamia), Miss J. Orr (North Eton), Miss I Palmer (Invicta), W. Richardson (Babinda), Miss M. T. Smith (Plane Creek), G. Tait (Pioneer), F. W. Trulson (Pleystowe), R. D. Woolcock (Racecourse), and V. F. Worthington (Farleigh).

The following persons have been appointed assistant cane testers for the forthcoming sugar season at the mills indicated—Miss A. Anderson (Plane Creek), P. C. Boettcher (Pleystowe), C. Boone (Tully), L. C. J. Clifton (Proserpine), D. M. Corbett (Kalamia), E. J. Delaney (Pioneer), Miss F. Foubister (Proserpine), H. J. Heidke (Pleystowe), H. L. Holthouse (Plane Creek), Miss N. Hooper (South Johnstone), Miss M. A. Lyle (Farleigh), R. A. Mahoney (Marian), V. B. Martin (Racecourse), S. McRostie (Kalamia), Miss M. Morris (Tully), J. H. Murtagh (Racecourse), Mrs. M. E. Nally (Inkerman), Miss E. M. Rowe (Invicta), C. E. Savage (Farleigh), Miss P. Southwick (Babinda), J. Y. Taylor (Marian), D. Walton (Invicta), P. A. Van Lith (North Eton), Miss M. E. L. Wassell (Pioneer), and Miss S. Wilkinson (Cattle Creek).

The following persons have been appointed honorary rangers under the Animals and Birds Acts, as from the 29th May:—Messrs. F. W. Finlay (Riverview), B. G. White (Yimbun), A. Williams (Toogoolawah), T. Helander (Rita Island, Ayr), and J. F. J. O'Connor (Ayr).

Police Constable R. Holben, of Eumundi, has been appointed also an inspector of slaughterhouses, as from 29th May.

Mr. E. R. Gibson, Clerk of Petty Sessions, Mossman, has been appointed also chairman of the Mossman Local Sugar Cane Prices Board and an agent of the Central Board for the purpose of making enquiries with regard to sales and leases of assigned lands, vice J. P. Lee, transferred.

Mr. H. St. J. Pratt, Instructor in Fruit Culture, Department of Agriculture, Stanthorpe, has been appointed Senior Instructor in Fruit Culture.

Constable W. E. Lynam, Tinana, and the non-commissioned officers in charge of the police at Longreach, Aramac, Barcaldine, Isisford, Jundah, Muttaburra, and Tambo, have been appointed also inspectors under the Brands Acts.

The following have been appointed also inspectors under the Slaughtering Act:—Constables W. H. Anger, J. T. King, and J. H. Sprenger (Longreach); W. C. C. Sprenger (Aramac); W. C. Cutler (Alpha); J. F. O'Connor (Barcaldine); R. J. Cowan (Blackall); W. Mollenhauer (Isisford); V. C. Mahoney (Jericho); C. R. G. Thomson (Tambo); R. P. Hagarty (Windorah); and I. E. B. Wardrop (Winton).

Mr. G. H. Jenkins, M.Sc.App., B.Sc., A.A.C.I. Fairymead Sugar Co., Bundaberg, has been appointed assistant mill technologist, Bureau of Sugar Experiment Stations, Department of Agriculture and Stock. Another appointment to the Bureau of Sugar Experiment Stations is that of Mr. H. G. Knust, of Tully, who will fill the position of instructor (sugar cane culture).

Mr. H. M. Groszmann, Assistant to Horticultural Research Officer, Department of Agriculture and Stock, has been transferred to Nambour.

The following transfers of Inspectors in the Department of Agriculture and Stock have been approved:—Mr. S. C. Smith, Inspector of Slaughterhouses and Dairies, from Cairns to Mackay; Mr. J. R. Canty, Inspector of Slaughterhouses and Stock, from Innisfail to Cairns; and Mr. J. T. Littleton, Inspector under the Stock, Slaughtering, and Dairy Produce Acts, from Brisbane to Innisfail.

Appointments of honorary rangers have been made as follows:—Mr. E. M. Bauer, Molle Islands, Proserpine, honorary ranger under the Animals and Birds Acts; Mr. S. Zlotkowski, Ashra Downs, Muttaburra, honorary ranger under the Native Plants Protection Act; and Mr. O. J. S. Craig, "Bunya Tavern," Bunya Mountains, via Dalby, honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. W. Booth, of Bebo, via Yelarbon, has been appointed an honorary inspector of Stock, and Constable A. Still, of East Bundaberg, an inspector under the Slaughtering Act and the Brands Acts.

Sugar Cane Assessments.

An Order in Council has been issued under the Regulation of Sugar Cane Prices Acts fixing the general assessment for the Sugar Cane Prices Fund on all sugar-cane produced in Queensland during the coming season at 1¼d. per ton. In addition, special assessments are levied on cane supplied to the Mossman, Pioneer, and Inkerman Mills for the purpose of checking by survey the assigned sugar-cane lands in those districts in accordance with "*The Regulations of Sugar Cane Prices Acts Amendment Act of* 1931." These special assessments are at the rate of 1d. per ton in the case of Mossman, and ⅜d. in the case of Pioneer and Inkerman Mills.

Local Butter Marketing Scheme and Equalisation System.

An Order in Council has been passed amending the constitution of the Queensland Butter Board with regard to the Local Marketing Scheme and Equalisation System. Previously, if moneys held by the Board and urgently required by the factories were to be distributed, the distribution had to be effected on the basis of sales over a period of twelve months preceding the distribution, that is, on the basis of sales not made within the period during which the new marketing arrangements have operated. The present amendment now enables the Board to distribute moneys which belong to the factories as they become available, and on the basis of sales within periods during which such moneys have been accumulated. Also, the Board has been empowered to take action in the case of refusal or omission to furnish returns of sales to the Board.

Wild Life Preservation—New Sanctuary Near Rockhampton.

An area of about 3,600 acres of land on Hedlow Creek (parish of Barmoya, county of Livingstone), owned by Mr. M. C. Beak, Sandringham, Green Lake road, via Rockhampton, has been declared a sanctuary under the Animals and Birds Acts, in which it shall be unlawful for any person to take or kill any animal or bird.

Northern Pig Board Levy.

The Governor in Council has approved of the issue of Regulations Nos. 508 and 509 under the Primary Producers' Organisation and Marketing Acts, empowering the Northern Pig Board to make a levy on growers at the rate of sixpence (6d.) for each pig delivered to the board during the period from the 1st March, 1937, to the 31st December, 1940, to provide for the administrative expenses of the board. The amount of the levy will be deducted by the Northern Pig Board from payments due by the board to growers concerned.

Hereditary Unsoundness of Stallions.

Regulation 3 under the Stallions Registration Acts has been amended to include "Cryptorchidism" in hereditary unsoundness list for stallions.

Banana Levy Regulation Amendment.

A Regulation issued under the Fruit Marketing Organisation Acts in August, 1936, empowering the Committee of Direction of Fruit Marketing to make a levy on bananas marketed in Queensland, has been amended to provide that the Commissioner for Railways may collect the levy on account of the Committee of Direction on any consignments of bananas to Brisbane.

Wild Life Preservation.

An Order in Council has been issued under the Animals and Birds Acts, declaring "Braeside," Dalveen, the property of Mr. G. C. Cory, to be a sanctuary for the protection of native birds and animals.

Bundaberg Cane Growers Levy.

Regulations have been issued under the Primary Producers' Organisation and Marketing Acts, empowering the Bundaberg District Cane Growers' Executive to make a levy at the rate of one penny per ton for administrative purposes on growers of sugar-cane in its district.

Peanut Board.

Regulation 158 under the Primary Producers' Organisation and Marketing Acts has been amended to provide for a reduction in the rate of the levy by the Peanut Board from one farthing ($\frac{1}{4}$d.) to one eighth of a penny ($\frac{1}{8}$d.) per lb.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts giving notice of intention to extend the operations of the Peanut Board for the period from the 28th August, 1940, to the 27th August, 1947. Growers are given the opportunity of forwarding a petition for a poll on the question of whether or not the board shall be thus extended, such to be lodged on or before the 26th July next.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Peanut Board in regard to the tenure of officers of members of the board and the definition of a grower.

The amendments provide for triennial elections and a three years' term of office for all members of the board.

Persons who are deemed to be growers of peanuts and eligible to vote at any election or referendum shall be those who during the preceding twelve months have cultivated peanuts for sale in any part of the State on not less than half an acre of land of which they are owners or tenants under a written lease or agreement, or which they are farming under a written share-farming agreement, and who delivered to the board for sale all the peanuts produced for sale from such land.

District Executives and Sugar Mill Suppliers' Committee.

Regulations under the Primary Producers' Organisation and Marketing Acts embodying fees and allowances payable to members of district cane growers' executives and mill suppliers' committees have been amended to provide for alterations in the scale of fees payable to members of the Maryborough District Cane Growers' Executive and the Mount Bauple Central and Maryborough Mill Suppliers' Committees.

Registration of Veterinary Surgeons.

The Act providing for the registration of all persons engaged in the practice of veterinary surgery is now in operation. All persons who are eligible for registration should apply to the Registrar of the Board, Department of Agriculture and Stock, Brisbane, for the application forms provided by the Regulations, and other particulars.

Rural Topics

Improvements on Small Sheep Holdings.

When money is available a small pastoral holding frequently carries improvements fit for a much larger property. On the other hand, when finance is not available, the small holding often lacks even the bare improvements which are essential to the well-being of the sheep and the handling of the clip.

A holding has a certain capital value, and unnecessary improvements merely over-capitalise the property. Interest has either to be paid or allowed for this excess expenditure.

Certain improvements are, however, essential in all cases.

A substantial boundary fence and, should the district suffer from the depredations of dogs, netting and top netting are obviously necessary.

Next in importance is the water supply. Should there be adequate natural water the selector is fortunate. Failing natural water, wells, sub-artesian bores, surface tanks, or bore drains to conduct supplies from neighbouring bores must be provided. The type of watering facilities to be used is essentially a matter of economics. What pays best, particularly in drought emergencies, should be a guiding principle in the grazier's choice.

A horse paddock and yards for the handy working of house cows require early construction. This paddock should, of course, be handily situated to the homestead and should contain water.

Subdivisions of the property for the convenient working of sheep is seldom given sufficient thought. It involves not only the running of fence lines, but their construction in such a manner that water is easily and continuously available to the stock. The fences themselves should be substantially erected to obviate continuous drafting and boxing. Too much money may be spent in wrongly thought out subdivisions, but generally speaking, the smaller the paddocks the better. The posts used for fencing should consist of timbers proved in the district for their durability.

The shearing shed and drafting yards may, on a small holding, be lumped together. The shed should be well constructed and properly designed, but not larger than is desirable for the competent handling of the numbers ordinarily run on the property. The yards also should be constructed substantially, and their correct design for the drafting of sheep is of first importance. Where shed and yards are together the latter should be so placed that the shed can be conveniently filled with woolly sheep.

Finally, the situation of the house should permit the easy working of the property, and its cost should be no greater than the improved value of the holding warrants.

The Importance of Washing the Udder.

An essential feature in clean milk or cream production is the thorough cleaning of the cow's udder before each milking. Clean water and cloths should always be available for this purpose in the milking shed, and a few crystals of Condy's crystals should be added to the water used.

If this precaution is taken the milk will not be contaminated with cow's hair, scaly material, dirt, soil, &c. Materials of this type carry innumerable germs which rapidly increase and produce early deterioration in the milk or cream.

During cream separation the dirty grey or brown slimy residue in the bowl indicates the extent to which the cream is affected.

When clean milking is practised and the milk is strained through cotton filter discs into clean utensils, the slime in the separator bowl will be almost white and the cream is relatively free from dirt carrying undesirable bacteria.

Scores of tests carried out by the methylene blue test which is the best known factory method for differentiating between clean and unclean milk, clearly show a very marked improvement in the quality of milk where the udder has been washed.

Dirty milk may contain from 4,000,000 to 20,000,000 bacteria per cubic centimetre, whereas this number can be reduced to less than 500,000 per cubic centimetre by taking care that the udder, hands, utensils, &c., are thoroughly clean.

A great proportion of inferior cream is caused by bacterial contamination due to the omission of three most important processes—thorough washing of the udder of the cow and the milker's hands, thorough scalding of all utensils after each milking, thorough cooling and mixing of cream.

Nutritional Requirements of Poultry.

Poultry raisers as a whole have a very fair idea of the principles and practice of feeding, and take into consideration factors that make for efficient and economic production.

The present day values of cereals may induce some to depart from old and accepted practices in order to reduce costs. There are three points, however, that must not be lost sight of if the best results are to be obtained and the general health of the stock maintained, viz., the vitamin content of the ration, the protein content, and the quantity supplied.

Vitamins.—Vitamin A is of outstanding importance at the present juncture, for a shortage in the ration may cause outbreaks of nutritional roup as well as lowered egg production. The feeding of yellow maize and green feed ensure a sufficient supply of this vitamin. The price of maize will, however, preclude its inclusion in the ration to the same extent as in past years. Wheat will be used to replace this cereal, and so one source of vitamin A is lost.

On most poultry farms during the winter months, green feed is not plentiful, consequently under normal circumstances the loss due to a shortage of maize cannot be overcome. It is, therefore, of paramount importance that the poultry raiser should make a special effort to supply the birds with good succulent green feed. Green feed is the cheapest form in which the birds' requirement of this vitamin can be supplied. In cases where home-grown green feed cannot be obtained, poultry raisers should use at least 10 per cent. of good green lucerne chaff or meal in the mash fed to their birds.

Protein.—To obtain the maximum economic production, laying birds should have in their ration (i.e., grain and mash) a total of approximately 15 per cent. of crude protein. Maize has about 10 per cent. and wheat about 13 per cent. of protein. Where maize has been used extensively and is replaced with wheat it may be desirable to reduce slightly the protein content of the ration. This is most easily brought about by a slight reduction in the meat meal fed.

Generally speaking, however, the protein-rich meat meal is not overfed, and its greater use is advisable in certain circumstances. This is particularly so in the case of the poultry raiser who feeds extensive quantities of skim milk to his birds. With the approach of winter the milk supply will probably diminish. In such cases, the loss of protein of animal origin in the form of milk should be supplemented with meat meal.

Quantity.—Providing the right kind of food is being used, economic production is only possible by feeding the birds all they will consume. Do not be afraid of making your birds unduly fat. The good producer will convert the food supplied in excess of body requirements into eggs. Birds which cannot do this should be culled and sold for table purposes.

Beef Cattle Management.

Extensive canning operations are in progress throughout the major meatworks in Queensland, and they furnish an excellent opportunity for the cattle-man to practise rigorous culling. All aged animals of either sex, speyed cows, and beasts of an unfit type, including calves, should be marketed.

The remaining stock should be regarded as "chiller" grade animals. Rigorous culling will lessen the demands on the available feed, and young steers will, therefore, have a better opportunity to develop normally. Similarly, the breeders will have a better chance of producing healthy calves.

The practice of handfeeding any but valuable stock would soon prove ruinous on a large holding, and even on a small property, where mixed farming is carried on, the beef animals must come last on the list of stock eligible for supplementary concentrate rations.

On most runs there is one objectionable feature which should receive attention, and that is unclean water. Clean water must be protected by fences, or by drawing off into troughs. Even the approaches should be stoned or corduroyed. Foul or extremely dirty supplies should be fenced off, or at least partly purified, by the liberal use of burnt lime or fresh ashes.

A stock lick is a great help to cattle on most Queensland properties. No elaborate preparation is required. Equal parts of salt and bone-meal make a suitable mixture. Where heavy consumption makes the expense unduly high, the bone may be partly replaced by old wood ashes. A regular inspection is advisable so that steps may be taken to remedy any fouling of the mixture.

Our Untold Timber Wealth.

What Ivor Brown says in the following extract from an article in "Wood," a forestry magazine published in England, should have an especial appeal for Queenslanders:—

"The case for knowledge, whether it is knowledge of roots or rocks or bees or butterflies, is not that your head is thereby stuffed with a paper army of Latin names; for that kind of ornithology or botany I have no use whatever. Collecting eggs, skins, fossils, and dead flowers, and labelling them with the utmost correctitude is a dreary and very often a sadly destructive pastime. True knowledge of natural history has nothing to do with pedantic collection and possession; it is the information which leads to understanding and opens your eyes as you take a country or suburban walk or even a stroll in the city park, the information which enables you to comprehend why such and such a flower or tree is found in this or that place, its particular function in the natural scheme, its beauties, and its utilities.

"The case for intelligent instruction of children in the nature and quality of our native timber is overwhelming. I say "intelligent" instruction because this kind of teaching can be desperately dull; it should be kept as far as possible from the examination syllabus, the prize for quick responses, and the honour that goes to the ready rattle of a list of names. It should be based not only on the picture-book and the text, but on the actual growth of the roadside, the playing-field, and the adjoining country. If such teaching is given by lively minds, it must add enormously to our comprehension of England, not only of our legacy of English beauty but to our understanding of social developments.

"Timber, the first material of manipulative man, the especial foundation of our island-story, the oaken face that launched a thousand ships, the buried forests of the coal-measures, the chair we sit on and the desk we write on, the visual glory of our plans and parklands and the pit-prop yielding conifers and cover of our foothills—what was I ever taught about all that? Yes, there was one thing. The English yew and the English bowman. How curious that education should select one aspect of England's timber story which has left the least mark! The record, for example, of the English oak and its manifold usages in ship and house building as well as for furnaces and for furnishing would sum up a considerable fraction of the English heritage. But it was always the yew.

"Education has marched, since I was learning all about Virgil's woods and unable to recognise my own. It does, I believe, place far less reliance on the twigs of the birch and on the slender form of imported timber which bears the name of rattan. I trust that its notions of natural history have equally progressed since I, as Bughunter, loafed among the woods I could not name and did not appreciate or understand. If there ever was a subject which could be made to fascinate an intelligent boy or girl and lead him or her on to the enjoyment of the rural scene and to lively social speculation, it is the nature of our British woodlands and their relation to our earth, our climate, the beauty of our land, and the history of its people.

ANNUAL SCHOOL OF INSTRUCTION FOR DAIRY AND PIG FARMERS.

Preparations for the school of instruction for dairy and pig farmers, which is held annually at the Queensland Agricultural High School and College, Lawes, are in progress. This year the school will open on Monday, 23rd August, and conclude on Saturday, 4th September. The fee is £3 10s. for the full course, and will cover board, lodging, and instruction (and excursion). Concession fares will apply to rail travel. Early application to the Principal, Queensland Agricultural High School and College, Lawes, Queensland, is advised.

Students travelling by rail should book to Lawes, noting also that express mail trains do not set down or pick up passengers at that siding. Further information may be obtained direct from College or from the Department of Agriculture and Stock, Brisbane.

Orchard Notes

AUGUST.

THE COASTAL DISTRICTS.

IN many centres the bulk of the citrus fruits, with the exception of the late-ripening varieties, will have been harvested, and cultural operations should be receiving attention.

Trees which show indications of impaired vigour will require a somewhat heavy pruning, both in respect to thinning and shortening the branches. Where the trees are vigorous and healthy a light pruning only will be necessary, except in the case of the Glen Retreat mandarin. The densely-growing habit of this variety leads to a profusion of weak shoots, which, if allowed to develop, will be responsible for overbearing and resultant small and inferior fruit at an early age.

Where trees show signs of failing, investigations should be made at or near ground level for the presence of collar rot. The roots should be examined for disease, and in the North Coast districts for the presence of the citrus root bark channeller. A light application of paradichlorobenzene buried a few inches deep in circular drills around the tree and with the surface stamped firmly has been recommended for controlling this pest. The distance between the circular drills should be not more than 18 inches, and care should be taken to prevent the crystals of paradichlorobenzene from coming into contact with the roots. It may be necessary to repeat the application after an interval of three or four weeks.

Where it is necessary to control black spot, melanose and scab, the fungicide should be applied at the correct time. The control measures recommended are—

For Black Spot.

Bordeaux of 3-2-40 strength or Bordeaux of 3-2-40 strength + 1 per cent. of oil emulsion—

(1) As soon as the fruit has set;
(2) About a month to six weeks later;
(3) If black spot has been serious previously, another application just prior to the February rains.

For Melanose.

The use of a similar fungicide—

(1) Immediately the fruit has set;
(2) A month to six weeks later, or more often if the weather conditions are exceptionally wet.

For Scab.

(1) Bordeaux mixture 6-4-40 or Bordeaux 6-4-40 + 1 per cent. oil emulsion immediately before the new growth commences; this will help to clean up fungus on the old scabs;

(2) Bordeaux 3-2-40 or Bordeaux 3-2-40 + 1 per cent. oil emulsion at about the middle of the flowering period; this and subsequent applications are for the protection of young foliage and fruit;

(3) Bordeaux as soon as the fruit has set;

(4) If the season is exceptionally wet, it is advisable to give one or two further applications in order to keep the young fruit and foliage well covered.

Where for any reason healthy trees of vigorous constitution are unprofitable, they may be headed back—in fact, have the whole of the top removed—leaving a few selected arms. All other branches should be cut away at their source of origin. The three or four remaining arms, whose lengths will vary from 2 to 4 feet, will form the future framework of the tree. Care must be taken to cover the whole of the exposed bark with a suitable coating of whitewash to prevent sunburn. The numerous shoots which will grow from main arms are suitably reduced, leaving from two to four on each arm. Under favourable conditions these will be in a fit condition to receive selected buds from desirable trees by the following autumn.

It is desirable that, when shoots intended for budding have attained a length of from 6 to 9 inches, their terminals should be nipped off in order to stiffen their growth and guard against the possibility of damage by strong winds.

Fertilizing should be completed as early as possible, the mixture for the spring application being high in readily available nitrogen. Ploughing should then be completed, the depth of this being regulated by local conditions and the nature of the original preparation of the land. Following upon the ploughing the land should be worked down to a fine state of tilth. On hillside orchards attention should be given to the care of possible storm waters. Cultivation should be so arranged as to form shallow drains or banks along the tree rows and across the heaviest slope, leading into suitable side drains which may be grassed to prevent erosion.

The planting of trees may be continued and, with the exception of custard apples, expedited. The attention of citrus growers should be confined to varieties suited to their local conditions.

The pruning of grape vines should be completed, and where cuttings for planting are required these should be selected, trimmed, and heeled-in in slightly dry soil. Canes intended for cuttings should not be allowed to lie about and dry out, but should be treated the day they are severed from the plant. Cuttings are frequently made of excessive length; however, from 10 to 12 inches is a suitable length which allows for insertion in the soil so as to permit of the top bud, with a short section of the internode, protruding above the surface.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

ALL pruning other than that applied to peaches and varieties which are late in coming into growth should be completed this month, and the planting of young trees, if not already done, should no longer be delayed. Early planting is preferred, the sooner after the fall of leaves the better. When there are indications of the swelling of the buds, the time is opportune for wroking over unprofitable trees, where the stock is reasonably vigorous. Strap grafting, as advised by the local field officers, is the most satisfactory method of top-working deciduous trees.

The pruning of vines should be postponed as long as circumstances permit, and these can only be gauged on actual observation as they are subject to much variation.

The usual winter working of the land is essential for the retention of moisture and aeration of the soil, but in shallow soils in which many orchards are planted deep working is most detrimental. The matter of seedling stocks for apples and the inferior plants frequently received from Southern nurseries prompts a query as to how many seeds have been stratified for spring planting, and whether any effort is being made towards raising a local supply of nursery stock.

CHEEPLY MADE RUG FOR DAIRY COWS.

As a means of assisting the dairy cow to conserve heat (and thus preventing food wastage), the rugging of the animals during at least a portion of the winter is well worth while, especially in colder districts and situations. Many farmers would like to rug their cows, yet cannot afford to purchase the market article. The farmer can, however, make his own cow rugs for little more than the cost of the bags, a ball of twine, and a sewing needle, plus his own ingenuity.

Two bags (cornsacks or any heavy bags will do), or three for larger cows, will make a nice rug. Split them down the seams and join together and place on the cow. Next cut off a strip from 10 to 18 inches wide so that the rug will not hang too low. This need not be wasted; it is folded, and when sewn to the rug provides the strap for the thighs, this being the only strap used. The front is now fitted by turning up the front corners and sewing them to the sides of the rug. This strengthens the rug and obviates the necessity for cutting off the spare portion which the cow would tread on. The two turned-back portions are then measured and sewn to fit fairly tightly to the cow's neck. The back strap is fitted 12 to 15 inches below the rump level, and the rug is complete.

This home-made rug will keep the cow warm, and after a few days' wear, when the oil, etc., from the cow's body has worked into the rug, it will also be waterproof. The rug can quite easily be slipped off and on over the cow's head, and it is advisable to remove it daily except on rainy or very bleak days. The cow's name painted on the rug over the rump with tar prevents confusion in replacing the rugs.

Farm Notes

AUGUST.

THE most important work during August will be the preparation of the land for all spring-sown crops. The better the cultivation the better the results that can be expected. Potato planting will be in full swing this month, and in connection with this crop the prevention of diseases calls for special attention. Where possible, seed potatoes should be selected from localities which are free from disease; they should be well sprouted, and, if possible, should not exceed 2 oz. in weight. Seed potatoes of this size are more economical to use than those large enough to necessitate cutting. However, if only large-sized seed are procurable, the tubers should be cut so that at least two well-developed eyes are left. The cut surfaces require to be well dusted with slaked lime or wood ashes as soon as possible after cutting. If considered necessary to prevent possible infection by scab, potatoes should be treated with hot formalin or acid corrosive sublimate. Details of the method employed may be obtained from the Department. When treatment has not been carried out prior to sprouting it should be delayed until a day or so before planting. Where cut tubers are to be sown, they should be dipped before cutting.

In localities where all danger from frosts is over, sweet potato cuttings may be planted out. This crop deserves more attention owing to its value for both culinary and stock food purposes.

Arrowroot may also be planted this month in suitable localities.

With the advent of warmer weather weed growth will increase, and cultivators will be kept busy in growing crops, and land being prepared for sorghums, millets, maize, cotton, and summer growing crops generally.

THREE DAY SICKNESS.

Three day sickness is a disease of unknown origin, but, like influenza and small pox it is probably caused by a very minute parasite. It first appeared in the Gulf Country about a year ago and may have been introduced to the continent through the accidental carriage of infected insects from countries to the north of Australia.

As the disease spread with great rapidity through the State, and then along the coastal districts of New South Wales in a few weeks, it is possible that some factors other than insects may also play a part in spreading the disease.

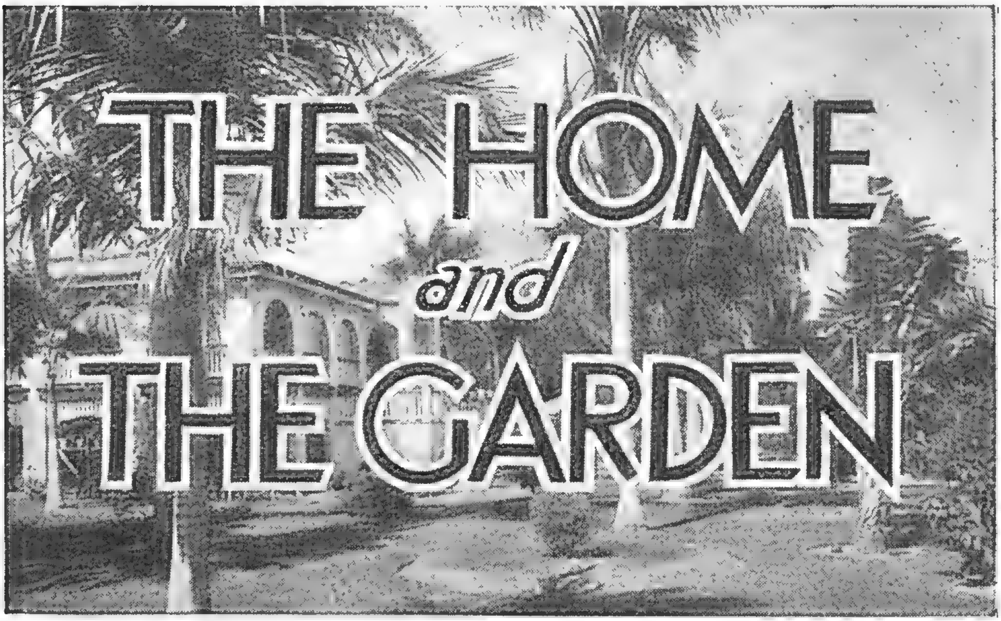
The disease is characterised by a high fever which lasts for a day or two. There is a discharge from the eyes and nose, and, in many cases, lameness in one or other of the limbs is marked. The animal shows a disinclination to move. It prefers to lie down in the shade and remain so during the day or so that represents the acute phase of the disease.

Treatment is not necessary and the animals should be left wholly undisturbed, if possible. This, of course, cannot be always carried out, particularly with milking cows which have to be milked twice daily.

Cows in full milk show a marked decline in the milk produced, but the yield usually returns to normal when the animals show signs of recovery or shortly afterwards.

In severe cases, animals may develop a marked weakness in the hind quarters and show difficulty in rising. This symptom is temporary only though it sometimes persists for several days. The animal should then be fed off the ground and turned over from one side to the other two or three times a day.

Redwater has occurred in some of the herds on tick infested country during the three days sickness outbreak and has caused some losses. This is due to the fact that animals on ticky country are normally "carriers" of the redwater organisms. So long as the animal is quite healthy, these organisms are harmless, but immediately there is a weakening of the constitution of the animal, as may occur during three day sickness, they increase in numbers and produce redwater. If this happens, the animal has to receive appropriate treatment.—Dr. John Legg.



OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

A BREAKFAST TABLE CONVERSATION.

IT was an hotel in a small country town in the west of Queensland. I sat with a young man on my right. I had never seen him before, and shall probably never see him again. Breakfast is more cheerful with a little conversation than eaten in glum silence. So I made a beginning with the weather.

Pasteur and Lister.

Then changing the subject—"What keeps people in this town out of bed till midnight?"

"The pictures."

"Ah! Was it a good picture?"

"Yes, it was Pasteur."

"That is a good picture. I saw it in Brisbane some time back. I suppose not one Australian in a thousand had ever heard of Pasteur. Listen, I will tell you something. Some years ago a Paris newspaper offered a prize, for which the competitors were to name the ten greatest Frenchmen. Who do you think headed the list; Napoleon, Victor Hugo, General Foch? Not one of these. Louis Pasteur came first. Can you imagine Australians or Englishmen placing a man of science in the first place in such a competition?"

"There lived recently an Englishman who was a firm friend of Pasteur and as great as he. He was Joseph Lister, the discoverer of

antiseptic surgery. How many Australians know anything about Lister, except perhaps his name? Pasteur showed us that many diseases are caused by germs; Lister showed us how to keep disease germs out of wounds. If you were thrown off your horse, and broke your leg, and the bone stuck out through the skin, who would save your life after you were taken to hospital? Why, of course, Joseph Lister!"

Children and Milk.

I changed the subject. "I suppose an experienced stockman can tell at a glance whether a mob of cattle is poorly nourished?"

"Yes, certainly."

"Yesterday, I met a mob of small children coming out of school. I looked at them carefully. They were a poor lot; one of the worst I have seen in Queensland. Most of them were too thin, and many of them had legs like broomsticks. This is not the fault of the district, nor do I think it is due to want of money. You can find in this district poor parents who have well nourished children, because they drink plenty of milk, mostly goats' milk. There are plenty of goats here. In a season like this you can get plenty of goats' milk for nothing at all—nothing but a little trouble."

The Small Boy.

On my left sat a boy of four years, very neatly clothed, very well behaved, very quiet. I thought I would give him a turn.

"Yesterday I saw a number of small boys riding bicycles." He responded instantly with a smile.

"I ride a bicycle at home. It has three wheels."

"You will learn to ride on two wheels some day."

The boy's mother was not there. He was in charge of a friend. Just then he asked him what he would have to drink.

"Water," he said.

Better than tea, I thought. But I handed him the milk jug.

"Won't you drink this beautiful milk?"

"No, I like water better."

His guardian said, "You should drink milk. It is so good for you."

Realising the futility of this I kept silent. Then, after an interval—

"Do you play cricket?"

"No."

"What do you play?"

"I like playing tennis."

"You will play better tennis, if you drink milk every day. There is something to think about."

A seed planted by the wayside. I fear it will never sprout.

Balancing the Diet.

(Contributed by the Queensland Nutrition Council.)

A GREAT authority on nutrition after investigating the diets of all types of people, rich and poor, was convinced that the majority of mankind lives on a diet which is defective in some respect. That does not necessarily mean that the majority of people are starving. Many people may and do eat more than enough food of a "kind", yet their diet may be defective in some one type of food constituent, *i.e.* their diet is not well-balanced. For example, in Australia, the people as a whole eat too much sugar and white flour and not enough fruit and vegetables, milk, eggs, and cheese. How then are we to balance our diets? Before we can do this intelligently, we must know something of the different types of food constituents.

Foodstuffs, as commonly used, may contain all or some of the six essentials in any diet, viz.—water, carbohydrates, fats, proteins, minerals, and vitamins.

(1) *Water* is contained in most foods, even in solids, such as vegetables and fruit, bread and meat, while good milk contains about 87 per cent. of water. Water is very essential to a well-balanced diet, and may be taken as "Adam's Ale", when at least six glasses daily would be needed, or in the form of milk, tea, coffee, cocoa or soups.

(2) The next essential is *carbohydrates.* These, together with the fats, provide the body with energy and heat when digested. The carbohydrates should form about two-thirds of our daily food supply and include such substances as potatoes, fruit, vegetables, cereals, rice, sago, flour and sugar. *Bread,* consisting largely of flour, is one of the most commonly used carbohydrate foods; indeed, according to modern knowledge, it is often too commonly used. Wholemeal or cerevite bread should always be used in preference to white—for they are both much richer in the sixth essential—vitamins.

(3) *The Fats.*—The third essential of a balanced diet mentioned above includes such substance as butter, fat of meats, cream, oils and nuts, and here in Queensland should form about one-sixth of the total quantity of the daily food supply. In cold countries, such as Northern Canada, the Esquimaux live almost on seal and the blubber of whale, which consist largely of fat. In tropical and temperate climates, during summer, less fat is perhaps needed than during the winter.

(4) *Proteins* are the fourth essential of a well-balanced diet. These are usually known as body builders or strength producing foods. Meat, fish, eggs, cheese, peas and beans are foods rich in protein and these should form about one-sixth of the daily food supply. They are especially necessary for growing children. Men doing hard manual labour also require a good deal of protein, but the habits of people in Queensland generally ensure a more than ample supply for working men.

(5) The *mineral substances* come next among the essentials. Four important members of these are often deficient in the diet. These are—iron, lime, phosphates, and iodine. Iron is very necessary to keep the blood in a healthy state. Some of the foods which should be taken for their iron content are egg yolk, liver, whole-grain cereals, green vegetables, and dried fruits. Lime and phosphates are very necessary for the proper development of the bones and teeth, and also help in the formation of muscles and nerves. A lack of lime and phosphates in foods leads to many very serious conditions, especially in children. Milk,

cheese, oatmeal, carrots and potatoes are all rich in lime and should be included in the daily dietary. Of these, milk and cheese are especially valuable. For phosphates, foods such as milk, liver, brains, cheese, eggs, fish-roes should have a place in a well-balanced diet. *Iodine,* too, is essential in order to keep the body healthy. In districts where the food contains insufficient iodine, e.g., in certain parts of the Alps and in certain districts of New Zealand, a large percentage of the population develops goitre, a form of swelling in the neck. Oysters, cod-liver oil, eggs, potatoes (with skins on) and leafy vegetables, all contain sufficient iodine for the bodily needs.

(6) Now, the sixth and last essential of a well-balanced diet are *Vitamins,* of which there are many. The most important of these are known as A, B, C, D.

From what has been said, it will be very obvious that milk, meat, eggs, and cheese, fruit and green vegetables, along with wholemeal or cerevite bread, make a well-balanced diet. Attached will be found a table which will be a guide in the choice of foods and, if followed, will provide both variety and balance in the diet. The table:—

BREAKFAST.

BALANCE YOUR MEAL BY HAVING ONE FOOD FROM EACH OF THE FOUR GROUPS.

(1) Fruit.	(2) Milk.	(3) Cereals and Breads.	(4) Proteins.
Orange Pineapple Apple Pawpaw Bananas Grapefruit Tomato Apricot Peaches Cherries Pears Grapes (Fresh fruit is best, but stewed can be used for a change)	Certified milk Pasteurised milk (Lower grade milks should be boiled before being given to children)	Wheat Germ breakfast meal (*e.g.,* Cerevite) Stoneground wheaten porridge meal Firstbreak wheaten meal Cerevite bread Wholemeal bread Oatmeal (occasionally) ("Prepared" breakfast foods are not economical)	Egg— poached scrambled omelette fried boiled Lamb's fry Kidneys Fish Chops Steak Bacon Ham

LUNCHEON OR LIGHT EVENING MEAL.

BALANCE YOUR MEAL BY HAVING ONE FOOD FROM EACH OF THE FOUR GROUPS.

(1) Protein Foods.	(2) Salad Vegetables and Fruit.	(3) Starchy Foods.	(4) Milk.
Mutton Lamb Beef Cheese Fish Ham Tongue Pork Veal Poultry Rabbit Pea soup Nuts	Lettuce Tomato Celery Apple and cheese Beetroot Pineapple and cheese Onion Shredded raw carrot Radishes Fresh fruit (as for breakfast)	Potato (boiled in jacket) Cauliflower Cerevite bread Wholemeal bread Macaroni	As for breakfast, Milk soup

DINNER.

BALANCE YOUR MEAL BY HAVING ONE FOOD FROM EACH OF THE FOUR GROUPS.

(1) Protein Foods.	(2) Starchy Foods.	(3) Vegetables.	(4) Dessert.
As for lunch	Potatoes— boiled in jackets baked mashed Other starchy foods, as for lunch	Cabbage Lettuce Spinach Silverbeet Onions Carrot Cauliflower Tomatoes Parsnips Turnips Pumpkin	Fruit salad Pineapple Stewed fruits Custard made with milk and eggs

Australia, in fact the whole civilized world, is becoming nutrition-minded. Let us here in Queensland keep abreast in the forward march and introduce into our own homes a well-balanced diet. In this way, we may help materially in the building up of a strong and stalwart race, surpassing even our present high standard.

IN THE FARM KITCHEN.

PUDDINGS AND SAUCES.

When the cold weather has whetted the appetite, hot steamed puddings become popular items on the menu.

The puddings described here are suitable for this time of the year, and not the least attractive feature of many is the unusual sauce which accompanies them.

Plain Foundation Pudding.

Take 6 oz. flour, 1 teaspoonful baking powder, ½ gill milk, 2 eggs, 3 oz. sugar, 2 oz. butter, pinch salt, vanilla.

Beat the butter and sugar to a cream. Add eggs and beat well. Add milk and vanilla gradually. Lastly add the sifted flour and baking powder, and stir very lightly. Place in a greased mould covered with greased paper and steam for one and a half hours.

To make this into a Marguerite pudding, put a little jam in the bottom of the mould before filling in the mixture.

For a lemon pudding, add the grated rind of a lemon.

Sultanas, dates, currants, may be added. These give the pudding its distinctive name.

Marmalade Pudding.

Take 2 oz. butter, 2 oz. sugar, 4 oz. flour, ¾ teaspoonful carbonate of soda, 1 egg, 2 tablespoonfuls milk, 2 tablespoonfuls marmalade.

Cream the butter and sugar. Add the marmalade, beaten eggs and milk, then stir in the sifted flour and carbonate of soda. Pour into a well-buttered mould, cover with greased paper, and steam for about one and a half hours. Serve with marmalade sauce.

Delaware Pudding.

Take 10 oz. suet crust, 2 oz. chopped peel, 2 tablespoonfuls breadcrumbs, 1 large apple, 1 tablespoonful dates, or currants, 2 tablespoonfuls syrup.

Grease a pudding basin. Roll crust out thinly, and cut into varying rounds to fit and fill a pudding basin. Chop the apple. Mix all the ingredients together with enough syrup to make the mixture spreadable. Grease the basin and fill it with alternate layers of pastry and mixture. Have the last layer of pastry. Cover with a floured cloth. Steam for two hours. When turned out, coat with syrup flavoured with lemon juice to taste.

Ginger Pudding.

Take 3 oz. breadcrumbs, 3 oz. margarine, 2 eggs, 3 oz. brown sugar, 3 oz. flour, 1 tablespoonful preserved ginger, 1 teaspoonful baking powder, 2 tablespoonfuls ginger syrup, milk.

Rub the margarine into the flour. Stir in all the other dry ingredients, the chopped ginger and ginger syrup. Moisten to a thin batter with eggs and milk, if required. Grease a pudding mould, turn the mixture into it. Cover with greased paper. Steam for one and a half hours. Serve with ginger sauce or custard sauce.

Sweet Carrot Pudding.

Take 1 lb. carrots, ½ lb. breadcrumbs, 1 egg, 2 oz. butter, 1 oz. brown sugar, salt, lemon sauce.

Scrape the carrots, put them into boiling water, and cook until soft. Rub through a sieve. Add the breadcrumbs, sugar, butter, pinch of salt, sufficient beaten egg to bind well together. Butter a pudding basin, put in the mixture, and steam for about one hour. Turn out the pudding and serve hot with lemon sauce.

Heredotus Pudding.

Take ¼ lb. breadcrumbs, ½ lb. suet, ½ lb. raisins, 2 figs, ¼ oz. allspice, 1 egg, 1 oz. sugar, ½ lemon, 2 tablespoonfuls sherry.

Chop the suet finely and the figs. Cut the stoned raisins in half, and mix all the dry ingredients together, with the rind of a lemon grated. Beat the egg well and add it, and if necessary sufficient milk to make into a dough. Put into a buttered basin, cover with a scalded and floured cloth. Steam for four hours, and serve with sherry sauce, made by mixing half a pint of water with half an ounce of cornflour into a smooth paste, and then boiling it with an ounce of castor sugar for five minutes, stirring it all the time. A glassful of sherry can be added after it has boiled.

Steamed Victoria Pudding.

Take 8 oz. self-raising flour, 4 oz. suet, pinch salt, 1 bare teacupful water, 1 cooking apple, 2 tablespoonfuls apricot jam, sugar if liked.

Mix the flour and finely chopped suet together with a pinch of salt. Grate the apple, cut up the cherries, and add to the mixture with the jam. Mix with the water into a paste. Put into a greased basin and steam for two hours.

Lemon Sauce.

Take ½ pint boiling water, 1 lemon, 1 oz. loaf sugar, 1 dessertspoonful cornflour.

Rub the sugar on the lemon until the actual rind is removed. Dissolve this in the boiling water and simmer gently. Mix the cornflour into a smooth paste with a little cold water. Add some of the warm mixture to this, then pour all back into the saucepan, stirring it continually until it boils. Add the lemon juice and serve.

Cabinet Pudding.

Take 2 cupfuls breadcrumbs, 1 egg, ¼ pint milk, 1 tablespoonful sugar, ½ cupful raisins and currants, a few crystallised cherries.

Stone and cut up the raisins; make a custard with the egg and the quarter pint of milk and the sugar. Butter a mould, put a few glace cherries at the bottom,

then put a layer of breadcrumbs, and after that a layer of the dried fruit, and go on doing this until there are no more ingredients left. Then pour in the custard and steam gently for half an hour. Serve with a lemon sauce, made by boiling half a pint of water and a cupful of sugar to a syrup, with the juice and rind of one lemon. Thicken it with three tablespoonfuls of cornflour and stir in a tablespoonful of butter before serving.

Verney Pudding.

Take 4 oz. flour, 2 oz. sugar, 3 oz. butter, 2 eggs, 1 tablespoonful jam, ½ teaspoonful corbonate of soda.

Beat butter and sugar to a cream, add eggs, and beat thoroughly, add jam, stir in the flour and carbonate of soda, put into a greased mould, cover with a greased paper, and steam one and a half hours. Turn out and serve with jam sauce.

Sago Plum Pudding.

Take 3 tablespoonfuls sago, 1½ gills hot milk, ½ cupful breadcrumbs, ¾ cupful stoned raisins or sultanas, ½ cupful sugar, 2 oz. butter, 1 egg, ½ teaspoonful carbonate of soda, toffee sauce.

Wash the sago and strain it. Pour the hot milk on the sago and let it stand for three hours. Add the raisins to the sago with breadcrumbs, sugar, and butter. Put the mixture into a saucepan and heat it till the butter is melted. Beat the egg with the soda and stir it in. Pour it into a mould which has been well greased, and twist a greased paper over the top. Steam for two hours. Leave the pudding for three minutes before turning out. Pour toffee sauce round and serve.

Toffee Sauce.

Take 2 oz. butter, ¼ lb. golden syrup, ¼ lb. brown sugar.

Melt the butter and add the sugar and syrup, stir till it boils. Boil it for fifteen minutes. Stir till it begins to thicken, and pour it quickly over the pudding.

Sweet Sauce.

Take 1½ teaspoonfuls cornflour, 1½ teaspoonfuls castor sugar, ½ pint milk, flavouring to taste.

Mix the cornflour to a smooth paste with some of the milk. Heat the remainder and stir it on to it. Return it to the saucepan, bring it to the boil, and simmer for a few minutes, keeping it well stirred all the time. Add the sugar and flavouring and pour the sauce round the pudding.

Apricot Jam Sauce.

Put 1½ tablespoonfuls of apricot jam into a saucepan with ¼ of a pint of water. Boil it for a minute or two and use. A squeeze of lemon juice or a spoonful of sherry may be added.

Orange Sauce.

One large juicy orange, 2 oz. sugar, 6 drops cochineal.

Squeeze the orange juice on to the sugar. Dissolve the sugar slowly and boil it for eight minutes. Add the cochineal.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MAY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and stations.	Average Rainfall.		Total Rainfall.	
	May.	No. of years' records.	May, 1937.	May, 1936.
North Coast.	In.		In.	In.
Atherton	2·28	36	1·42	3·47
Cairns	4·56	55	2·61	4·81
Cardwell	3·64	65	2·64	3·51
Cooktown	2·85	61	0·62	3·28
Herberton	1·75	51	1·27	1·60
Ingham	3·66	45	2·27	2·69
Innisfail	12·58	56	3·59	14·49
Mossman Mill	3·95	24	1·53	4·09
Townsville	1·29	66	0·13	0·54
Central Coast.				
Ayr	1·12	50	0·24	0·10
Bowen	1·30	66	0·17	0·38
Charters Towers	0·79	55	0·03	0·38
Mackay	3·82	66	0·92	4·09
Proserpine	4·36	34	1·27	2·61
St. Lawrence	1·77	66	0·06	2·65
South Coast.				
Biggenden	1·70	38	0·28	1·59
Bundaberg	2·59	54	0·52	2·91
Brisbane	2·74	85	0·25	1·14
Caboolture	2·80	50	1·24	3·82
Childers	2·11	42	0·61	2·28
Crohamhurst	4·80	44	0·54	4·42
Esk	1·90	50	1·73	0·71
Gayndah	1·57	66	0·06	1·91
Gympie	2·79	67	0·51	1·71
Kilkivan	1·82	58	0·02	2·80
Maryborough	2·99	66	0·26	2·95
Nambour	4·68	41	0·94	5·34
Nanango	1·51	55	0·31	0·96
Rockhampton	1·61	66	0·09	1·06
Woodford	2·84	50	0·47	2·48

Divisions and stations.	Average Rainfall.		Total Rainfall.	
	May.	No. of years' records.	May, 1937.	May, 1936.
Central Highlands.	In.		In.	In.
Clermont	1·26	66	Nil	1·03
Gindie	0·88	38	..	1·04
Springsure	1·23	68	0·30	1·08
Darling Downs.				
Dalby	1·29	67	0·08	0·49
Emu Vale	1·13	41	0·29	0·56
Hermitage	1·13	31	..	0·32
Jimbour	1·20	49	0·20	0·31
Miles	1·45	52	Nil	0·15
Stanthorpe	1·81	64	0·34	0·82
Toowoomba	2·13	65	0·66	0·43
Warwick	1·50	72	0·29	0·71
Maranoa.				
Roma	1·36	63	Nil	0·26
State Farms, &c.				
Bungeworgorai	0·85	22	..	0·06
Gatton College	1·58	38	0·32	0·62
Kairi	2·06	21	..	..
Mackay Sugar Experiment Station	3·37	40	0·59	3·32

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—MAY, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure. at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·96	81	72	83	9, 11, 18	61	27	62	3
Herberton	..	75	54	82	14, 16	45	27	127	8
Rockhampton	30·07	82	59	90	16	47	19	9	2
Brisbane	30.10	76	55	84	1	49	19	25	5
Darling Downs.									
Dalby	30·09	74	45	81	6	34	18	8	2
Stanthorpe	..	68	35	75	2, 6	26	18	34	4
Toowoomba	..	70	46	76	2, 7, 25	35	18	66	4
Mid-Interior.									
Georgetown	30·00	87	56	91	10, 11, 14	49	14	Nil	..
Longreach	30·07	83	50	90	15	40	28	Nil	..
Mitchell	30·12	76	40	83	6, 7	29	19	Nil	..
Western									
Burketown	29·99	87	61	93	11, 25	53	19	Nil	..
Boulia	..	83	53	95	15	45	18, 30	Nil	..
Thargomindah	30·08	75	48	88	6, 7	39	19	Nil	.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	July. 1937.		August. 1937.		MOONRISE. July. 1937.	MOONRISE. Aug. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	6.45	5·7	6.35	5·21	12·1	1·4
2	6·45	5·7	6·34	5·22	—	2·8
3	6·45	5·7	6·33	5·23	1.3	3·11
4	6·45	5·8	6·33	5·24	2·7	4·9
5	6·45	5·8	6·32	5·25	3·13	5·2
6	6·45	5·8	6·31	5·25	4·21	5·51
7	6·45	5·9	6·31	5·26	5·25	6·33
8	6·45	5·9	6·30	5·26	6·23	7·11
9	6·44	5·9	6·29	5·27	7·13	7·47
10	6·44	5·10	6·28	5·27	7·58	8·22
11	6·44	5·10	6·28	5·28	8·38	8·56
12	6·44	5·11	6·27	5·28	9·15	9·32
13	6·43	5·11	6·26	5·29	9.47	10.9
14	6·43	5·12	6·25	5·29	10·25	10·50
15	6·43	5·12	6·24	5·30	10·58	11·31
						p.m.
16	6·43	5·13	6·23	5·30	11·32	12·17
					p.m.	
17	6·42	5.13	6·22	5·31	12·12	1.7
18	6·42	5·14	6 21	5·31	12·52	2·0
19	6·42	5·14	6·20	5·32	1·36	2·56
20	6·41	5·15	6·19	5·32	2·24	3·52
21	6·41	5·15	6·18	5·33	3·15	4·49
22	9·41	5·16	6·18	5·33	4·7	5·49
23	6·40	5·16	6·17	5·33	5·7	6·48
24	6·40	5·17	6·16	5·34	6 3	7·48
25	6·39	5·17	6·15	5·34	7·0	8·48
26	6·39	5·18	6·14	5·35	7·58	9·52
27	6·38	5·18	6·13	5·35	8·56	10.56
28	6.38	5·19	6·12	5·36	9·55	..
						p.m.
29	6·37	5·19	6·11	5·36	10·56	12·2
30	6·36	5·20	6·10	5·37	11·58	1·4
31	6·35	5·21	6·9	5·37		2·3

Phases of the Moon, Occultations, &c.

1st July	☽	Last Quarter	11 3	p.m.
8th ,,	●	New Moon	2 13	p.m.
15th ,,	☾	First Quarter	7 36	p.m.
23rd ,,	○	Full Moon	10 46	p.m.

Perigee, 6th July, at 7 p.m.
Apogee, 18th July, at 8 p.m.

Mercury will on the 8th arrive at that part of its orbit where it will be beyond the Sun from the Earth. More than 137 million miles separating us at this time from the "Inferior Planet" revolving, like Venus, inside of the Earth's orbit.

On the 18th Saturn, in Pisces, will be stationary—apparently—since dire results would follow were motion to cease but for a moment among the host of heavenly bodies. It is explained that when the Earth, as seen from a "Superior Planet," has reached its furthest distance east or west of the Sun the planet, as seen from the Earth, will seem at rest, because for a short period we will move either directly towards or away from it, after which the planet will resume its normal eastern or, apparently, western course.

Mercury, on its swift journey around the Sun in a quarter of a year will from the beginning of the month travel through the constellations Gemini and Cancer then, crossing the borderline into Leo will there, on the last day of the month, be in close vicinity to Regulus, less than half a degree from this first magnitude star on the ecliptic. They may be seen near the western horizon soon after sunset.

Mercury rises at 6.7 a.m., 38 minutes before the Sun and sets at 4.27 p.m., 40 minutes before it on the 1st; on the 15th it rises at 7.18 a.m., 35 minutes after the Sun, and sets at 5.45 p.m., 33 minutes after it.

Venus rises at 3.17 a.m., 3 hours 28 minutes before the Sun and sets at 2.11 p.m., 2 hours 56 minutes before it on the 1st; on the 15th it rises at 3.26 a.m., 3 hours 17 minutes before the Sun and sets at 2.7 p.m., 3 hours 5 minutes before it.

Mars rises at 1.37 p.m. and sets at 3.9 a.m. on the 1st; on the 15th it rises at 12.48 p.m. and sets at 2.25 a.m.

Jupiter rises at 6.9 p.m. and sets at 7.50 a.m. on the 1st; on the 15th it rises at 5.0 p.m. and sets at 6.50 a.m.

Saturn rises at 11.37 p.m. and sets at 11.43 a.m. on the 1st; on the 15th it rises at 10.43 p.m. and sets at 10.48 a.m.

The Southern Cross will be upright about 6 p.m. and on its side at midnight on the 1st but two hours earlier at the end of the month.

6 Aug.	●	New Moon	10 37 a.m.
14 ,,	☾	First Quarter	12 28 a.m.
22 ,,	○	Full Moon	10 47 a.m.
29 ,,	☽	Last Quarter	9 55 a.m.

Perigee, 3rd August, at 2 p.m.
Apogee, 15th August, at 1 p.m.
Perigee, 29th August, at 1 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling,** members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.

VOL. XLVIII. 1 AUGUST, 1937. PART 2

Event and Comment

The Sugar Situation.

IN the course of a recent address to his constituents at Mackay, the Premier, the Hon. W. Forgan Smith, LL.D., said the world, from a sugar point of view, differed from what it had been some years ago. Prior to the war Great Britain grew little sugar except experimentally. To-day, under a system of bounties, Britain was producing a fourth of her requirements. That bounty was frequently in excess of the value of the sugar produced, or 100 per cent. more on the world value of sugar at certain times. That policy was introduced in order that Britain would not have to depend entirely on other countries for the whole of her food supplies. Soviet Russia, which previously was not a big producer of sugar, would have 3,000,000 tons this year, a large proportion of which would be exported, though the people, if given an opportunity, would be well able to consume it all. In other industries excess production brought down the value of the goods actually sold, and that was the position in the sugar industry; so the recent international conference had to find a way by which production could be controlled in the free market and that market supplied only with what it was able to absorb. The agreement provided for an expanding share of the free market; thus if consumption increased there Australia would be entitled to a proportionate share of such increase.

The peak year scheme adopted by the canegrowers of Queensland in 1929 provided for 611,428 tons, that being regarded as the economic limit of production owing to the uncertainty of markets overseas. With the quota now received and a protected market for five years, he suggested that the peak could be increased by 100,000 tons, making it 711,428 tons. It would mean that this quantity would be in No. 1 pool, which included Australian consumption plus the 400,000 tons Australia was permitted to export. If more than that were produced, it could be treated as excess sugar, as at present. This did not involve any increase in the total production of sugar-cane over what had been produced last year or this year.

Queensland's Agricultural Advantages.

FUNDAMENTALLY the things which counted in successful agriculture were water, soil and climate. All these advantages Queensland possessed in a remarkable degree, said the Minister for Agriculture and Stock, the Hon. Frank W. Bulcock, in the course of an address to farmers recently.

Continuing, he remarked that many had noticed that the House of Commons had adopted a measure for the development of agriculture in Great Britain. They might think that this was of small moment to agricultural industries in Australia or to themselves, but if they analysed the motive underlying the British plan they would find that it was designed to stimulate production along more efficient lines. It was proposed under this plan to make a charge of not more than £7,000,000 per annum to topdress agricultural land and improve the various branches of British agriculture.

As the British policy aimed at efficiency in agricultural production, so they should endeavour to promote efficiency in their own primary industries. Industries were governed by many factors, not the least of which was economics. They knew as growers that the economics of the sugar industry were such as to cause them a good deal of perplexity.

Mr. Bulcock reminded the gathering that in addition to making plans to compete on an equal footing with others in the United Kingdom they should not neglect their home market. Australia imported about 500,000 tons of agricultural products, all of which could be grown in Queensland.

"Those who are prepared to face facts must realise one thing," said the Minister. "That is that the expansion of the sugar industry is going to be slow and we must necessarily extend our other production so that we might justify our right to the land we now hold. To grow crops with the greatest efficiency we must provide for the vicissitudes of the weather."

Mr. Bulcock added that irrigation entered largely into the question of providing permanent water. He had received 100 different suggestions for schemes ranging from one based on the old Chinese system of drawing water from a bucket and dropping it on the ground to one involving the use of the most modern irrigation plant. At the same time, he suggested that irrigation was one of the most intricate problems connected with agriculture. Irrigation schemes would have to be worked out by the producers, financiers, technical men, the Government and probably the local authorities.

North Queensland—A Land of Opportunity.

ON his return to Brisbane from a tour of North Queensland, His Excellency the Lieutenant-Governor, Sir James Blair, said that he regarded the North as a land of opportunity, by reason of its magnificent resources. It was a rich region offering bright prospects for young, vigorous, earnest men not afraid of hard work and with a will to succeed, if they would go out and seek to establish themselves on the land. For the land-minded the opportunities were unlimited.

It was sometimes asserted that the North was not a place for white people. He wanted to challenge that. In cities, townships, and scattered areas of settlement he had visited all the schools, and had been impressed with the splendid health, physique and mentality of the children. They lacked nothing in comparison with the children of less tropical regions. Adults and children were a testimonial to the climatic conditions and the general suitability of the North to white settlement and development.

Rural Trends.

PRIMARY producing countries, like Australia, would eventually be faced with declining markets for their products, said Dr. Edmund Brunner, Professor of Education in the Teachers' College of Columbia University, New York City, in the course of a recent public address in Brisbane. Speaking on "Rural Trends," he said one of the most important trends of the present century was the urbanward drift of population. It dated from the beginning of the modern industrial era, but had become especially pronounced in the last half-century. In Australia the strictly rural population was less than two-fifths of the total, the metropolitan almost 47 per cent.

The farm family had a unity and cohesiveness that had never been equalled by the urban. Its sharply lower divorce rates showed this. The farm family was bound by a single interest—the co-operation of man with animals and plants in the task of helping to answer the world's prayer for daily bread.

The urban world must find solutions for its problems; the rural world must adjust itself to them. Educationally at least this adjustment had been but poorly made. It was charged, and with some justice, that the rural school trained its children away from the soil and toward the city. So in America they began to teach vocational agriculture and tried to keep rural youth in rural areas.

The interests and thoughts of rural men and women had broadened. Increasingly rural people had sought to understand the forces that baffled them. Increasingly they had sought outlets for expression in drama, in community service, in recreation.

Not all the changes had been losses, and over and above trends in organisation, in social and economic life, the rural people seemed to be taking a place of new importance in a society that was becoming increasingly interdependent.

It was the task of education to watch the more important trends and be ready to see the implications they held for the service they could give to the citizens of to-morrow, in order that some day the sun might rise on a world that knew the peace, the serenity and the satisfaction that to-day was found chiefly in the countryside.

The Treatment of Tobacco Seed-Bed Covers to Prolong their Useful Life.

J. H. SIMMONDS, M.Sc., Senior Pathologist, and L. F. MANDELSON, B.Sc.Agr., Agricultural Research Officer.

FOLLOWING on the announcement by the Council for Scientific and Industrial Research[1] that blue mould of tobacco could be effectively prevented in the seed bed by subjecting the seedlings to the vapour of benzol, the Department of Agriculture and Stock initiated experiments to ascertain how this new method of control could be adapted to Queensland conditions. Amongst other things a cheaper means of enclosing the gas than the standard cold frame was sought. A satisfactory method was found to be the provision of a calico tent fitting tightly over solid triangular ends and a wooden border along each side. In earlier work the calico for these tents and for the covers of experimental cold frames was treated with linseed oil as recommended by May[5] in New South Wales and later used by Angell, Hill, and Allan[1] in their experiments on the vapour treatment of seedlings. This was assumed to be necessary for the dual purpose of making the cover more translucent and more gas-tight. It was soon found that linseed oil possessed two distinct disadvantages. The calico was rendered very brittle and easily torn, and mould growth was intensified to such an extent that insufficient light was allowed through. Moreover, linseed oil is an expensive preparation to use. It therefore appeared that one way to cheapen the initial cost of the benzol method would be to find a suitable substitute for the oil treatment, and some attention was accordingly given to this line of investigation.

Methods Employed.

Altogether fourteen different materials or combinations were tried as calico dressings. These are listed in the summary on page 113. Four different experiments were involved in testing them. In two of these the treatment of the calico was carried out in the laboratory. Portions of each of the treated pieces were then removed and wrapped up together in a piece of badly mildewed canvas and the whole left moist. This ensured a rapid development of mould on those pieces not adequately protected and allowed a quick estimate to be made of the relative value of the treatments used. A second portion was tested under conditions conforming more to seed-bed practice. The piece of calico was either hung from a horizontal wire over an old tobacco seed-bed (first series) or used as a cover for a small cold frame (second series). The other two experiments consisted of field trials at Gayndah and Miriam Vale, in which entire seed-bed covers of the tent variety were treated and compared. R. A. Tarrant and N. E. Goodchild of the Agricultural branch were responsible for the work entailed in these field experiments.

Some of the treatments were tested in all four experiments and others of less promise in only one or two. No essential variation was noted in the relative merit of the same treatment throughout the experiments. A difference did occur, however, according to the length of exposure. A tabulated summary of the observations made will be found on page 113. The relative strength of the material was judged on an entirely arbitrary standard by the simple process of noting the ease with which it could be torn by the hands. As it was first assumed

that some form of gas and waterproofing was necessary, estimates of the relative waterproofing qualities were obtained by noting the time taken for equal quantities of water to percolate through a standard depression made in the calico tied over the mouth of a jar.

Discussion of Results.

Although these experiments were not by any means extensive, several interesting facts were demonstrated. In the first place, it was found that special proofing of the calico is unnecessary, and a mildew preventive is all that is required. As evidence for this conclusion the following facts may be cited. Not more than a 5 per cent. variation from the mean occurred in the total evaporation over 28 days when equal quantities of benzol were used in frames covered with calico treated with Shirlan, alum-lead acetate-glue size, Shirlan followed by soap-alum-gelatin, linseed oil, Shirlan followed by linseed oil, Shirlan followed by linseed oil in petrol, and Shirlan followed by paraffin wax in petrol. No differences were noted in the efficiency of blue mould control in any of these frames and the growth of the seedlings was similar throughout. The rate of diffusion of benzol through calico subjected to several of these treatments was the same for all, when once they had been exposed to the weather for some time, but in calico freshly oiled it was reduced to about one-half.

Summary of data regarding calico treatments based on the results of four experiments.

Material.	Mildew development		Loss of Strength.	Water-proofing.	Interpretation of symbols.
	3 Months.	6 Months.			
Untreated calico	+ + +	+ + +	—	+ + + +	*Mildew Development.* — Nil. + Slight (no importance). + + Moderate. + + + Serious. + + + + Very serious. —— *Loss of Strength.* — Nil compared with untreated. + Slight (no importance). + + Moderate. + + + Serious. + + + + Very serious. —— *Waterproofing.* + Good. + + Moderate. + + + Slight. + + + + Nil (similar to untreated).
Alum. Lead acetate	+		+	+ + + +	
Alum. Lead acetate + glue size	+	+ + +	+	+ +	
Shirlan NA. (W.S.) 1%	+		+	+ + + +	
Shirlan AG. 1%	+	+ + +	+	+ + + +	
Shirlan AG. Alum + soap + gelatin	+	+ + +	+	+	
Copper sulphate. Soft soap	+		+	+ +	
Paraffin wax in petrol	+ + + +		+ +	+	
Shirlan A.G. Paraffin wax in petrol	+ +	+ + + +	+ +	+	
Raw linseed oil	+ + + +	+ + + +	+ + + +	+	
Shirlan AG. Linseed oil	+ + + +	+ + + +	+ + + +	+	
Shirlan AG. Linseed oil in petrol (1 to 2)	+ + + +	+ + + +	+ + + +	+ + +	
Proprietary mildew preventive	—		+ +	+ + + +	
Proprietary waterproofing material No. 1	+ +		+ + +	+	
Proprietary waterproofing material No. 2	+ + + +	+ + + +	+ + + +	+	

One point strikingly demonstrated was that linseed oil is unsatisfactory in all combinations, since it intensifies mildew development and renders the fabric very brittle. The possible inclusion of this oil in the preparation of the two proprietary waterproofing materials used may have accounted for their poor showing. Paraffin wax dissolved in petrol, while excellent for waterproofing purposes, is also conducive to mildewing and tends to weaken the material.

A mixture containing paraffin wax, petroleum jelly, boiled linseed oil and mineral turpentine, similar in composition to proprietary waterproofing compound No. 2, has been recommended by Sharp[6] in Western Australia, but it evidently would be unsatisfactory under Queensland conditions.

The Shirlan-alum-soap-gelatin[3] combination proved a good waterproofing material without possessing the disadvantages of those containing paraffin, but the extra cost involved precludes its use for seed-bed covers where a high degree of proofing is apparently unnecessary.

One proprietary line containing copper napthenate gave good control of mildew in preliminary trials but was not further investigated on account of its high cost. The copper sulphate-soft soap application resulted in a bluish coloration of the calico, which was considered a disadvantage.

Two of the dressings were sufficiently satisfactory, when all aspects are considered, to merit their recommendation. These are the alum-lead acetate and Shirlan treatments. Although effective for several months, neither of these prevents mildew indefinitely, and, unless something better is discovered in the meantime, it may be necessary to renew the treatment each year. The alum-lead acetate method possesses the advantage of being somewhat cheaper, but is more cumbersome since it entails immersion in two separate solutions. However, further investigations may show that these can be combined into one without loss of efficiency. The details of these two methods are given below.

Alum—Lead Acetate.

The formula used for this dressing is based on one recommended by Holden[4] and was brought under notice by H. E. Young, Assistant Plant Pathologist. A modification simplifying the preparation and allowing for the addition of glue was suggested by N. E. Goodchild, but has not been fully investigated.

Two solutions are necessary, one of alum and another of commercial lead acetate (sugar of lead). The method of preparing 5 gallons of each, and the procedure entailed, is as follows:—

1. Place 1 lb. alum in 1 gallon of boiling water and stir until dissolved. Then add this solution to 4 gallons of cold water, making 5 gallons in all.

   Soak the calico in the alum solution for one day, kneading it well so as to ensure thorough wetting and to remove the sizing material from the cloth.

2. Place ½ lb. lead acetate in 1 gallon of boiling water and then stir until dissolved. Add this solution to 4 gallons of cold water making a total of 5 gallons as before.

   Remove the material from the alum solution when the required time has expired and wring lightly. Then soak it in the lead acetate solution for from 5 to 6 hours. Remove, wring lightly, and allow to dry.

The cost of the materials used in making up the two solutions of 5 gallons each is approximately one shilling at wholesale rates.

If it is desired to add some slight waterproofing properties to this dressing, ¼ lb. glue size or gelatin may be dissolved in a small quantity of the water heated for the purpose and added to the lead acetate solution.

Shirlan.

Shirlan is the proprietary name for a chemical substance which was first used and manufactured in England for restricting mildew development in cotton and woollen cloth. Later it was also found

useful as a fungicide for certain plant diseases. Cunningham[2] reports that Neil in New Zealand has found the water soluble form of Shirlan to be effective in protecting the canvas of tents against mould attack. In the experiments reported here an insoluble form known as Shirlan AG. was chiefly used. This consists of 25 per cent. salicylanilide together with a wetting and spreading agent. It may be obtained in Queensland at a cost of 9s. per 2 lb. tin.

For calico treatment it is recommended that the Shirlan AG be added to the required amount of water at the rate of 1 per cent. by weight. That is to say, ½ lb. of Shirlan AG. (one-quarter of a 2-lb. tin) is required for 5 gallons of water. When bought, the Shirlan may have settled hard in the tin and some care will be necessary to ensure that it is all stirred up before removing the quantity required. The calico is immersed in the mixture and kneaded well so as to ensure thorough wetting and to remove the sizing material. After it has been soaked for half-an-hour or so the cover can be hung out to dry.

As mentioned before it may be necessary in the case of both dressings to repeat the treatment each season in order to compensate for the leaching effects of heavy rain.

In putting down the seed-beds sufficient space should be left to enable the covers, when removed for ventilation, to be laid back to dry if necessary. Rolling the covers up tightly when they are wet with dew and rain, and leaving them thus for long periods, is very conducive to mildew development.

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DIGESTIVE DERANGEMENTS IN HORSES.

Most derangements of the digestive organs of horses are due to errors in diet and a good and regular system of feeding will do more to prevent digestive disease than anything else.

The following rules for feeding are generally accepted as correct:—

Water before feeding, and not for at least an hour after.

Feed in small quantities, and often.

Do not work hard immediately after a full feed.

Never give a horse large quantities of food to which it is not accustomed.

If these rules are followed, and care taken to ensure that only sound, good food is fed, very little trouble will be experienced.

The Avocado.

R. L. PREST, Instructor in Fruit Culture.

HORTICULTURALLY the avocado is a comparatively new fruit, particularly to Queensland. Its native home is generally conceded to be tropical America. Botanically the avocado is related to the laurel family, and early classification placed all varieties in one species, *Persea americana*. More recent studies, however, have resulted in making two distinct species, *P. americana* and *P. drymifolia,* the former including all varieties horticulturally grouped in the West Indian and Guatemalan races, and the latter including the small-fruited varieties of the Mexican highlands. The characteristics of these three races are—

(*a*) *West Indian race.*—Summer and autumn ripening, fruit large, with skin 1/16th to ¼ inch thick and leathery;

(*b*) *Guatemalan race.*—Winter and spring maturing, fruit large, with skin 1/16th to ¼ inch thick and woody in texture;

(*c*) *Mexican race.*—Leaves small and anise scented, fruit small and thin-skinned.

The tree is an evergreen, though some varieties shed nearly all their foliage for a brief period during flowering. The leaf blades are of many different shapes, e.g., oval, ovate, obovate, lanceolate, and elliptic, and in length they vary from 3 to 16 inches. The colour of the mature foliage is usually a bright green, and young foliage may exhibit various shades of red and bronze. The manner of growth of the trees varies considerably; the tall upright unbranched habit and the small well-branched spreading habit are both commonly met with.

The fruits in the cultivated species are extremely variable in size, shape and colour. In shape they may be round, oval or bottle-necked, or in any of the numerous graduations between these forms. The colour ranges from light yellowish-green through dark green, maroon, brown and reddish-brown to purplish black. The skin of the Mexican varieties is thin, whilst that of the Guatemalan varieties is thick, tough and even woody.

The edible portion of the avocado is the fleshy part lying between the skin and the seed, and is of a buttery consistency, from creamy to bright yellow in colour and often greenish near the skin. It contains a high percentage of oil. Normally each fruit contains only one seed, the seeds of the different varieties varying considerably in shape. The seed is inverted in the fruit so that the base is on the side away from the stem end. The seed is often covered with two seed coats of varying thickness.

In addition to being a fruit of merit, the avocado is an extremely nutritious food, and a particularly valuable addition to the dietary of a State such as Queensland with its sub-tropical to tropical climate. In Queensland the avocado is used chiefly as a salad. Because of the high fat content of many varieties, the avocado combines best with such sub-acid fruits and vegetables as oranges, grapefruit, lemons and tomatoes, although some orientals prefer sugar on it instead of an acid substance. Combined with catsup, lemon juice, vinegar or onion, the avocado makes a delicious sandwich spread. It may be served with sliced tomato; or, combined with cabbage, celery, cucumber and onion, it may be used for stuffing whole tomatoes. If preferred sweet rather than with acid combinations, avocado may be combined with apple or banana.

Plate 35.
An Eight-year-old Grafted Avocado.

The following are interesting recipes:—

Avocado pineapple salad (Six Servings)—

1½ cups grapefruit sections.
1½ cups orange sections.
¾ cup ripe mango slices.
1 cup avocado slices.

Remove membrane from the orange and grapefruit sections; chill all the ingredients, arrange on lettuce leaves, and serve with French dressing or mayonnaise.

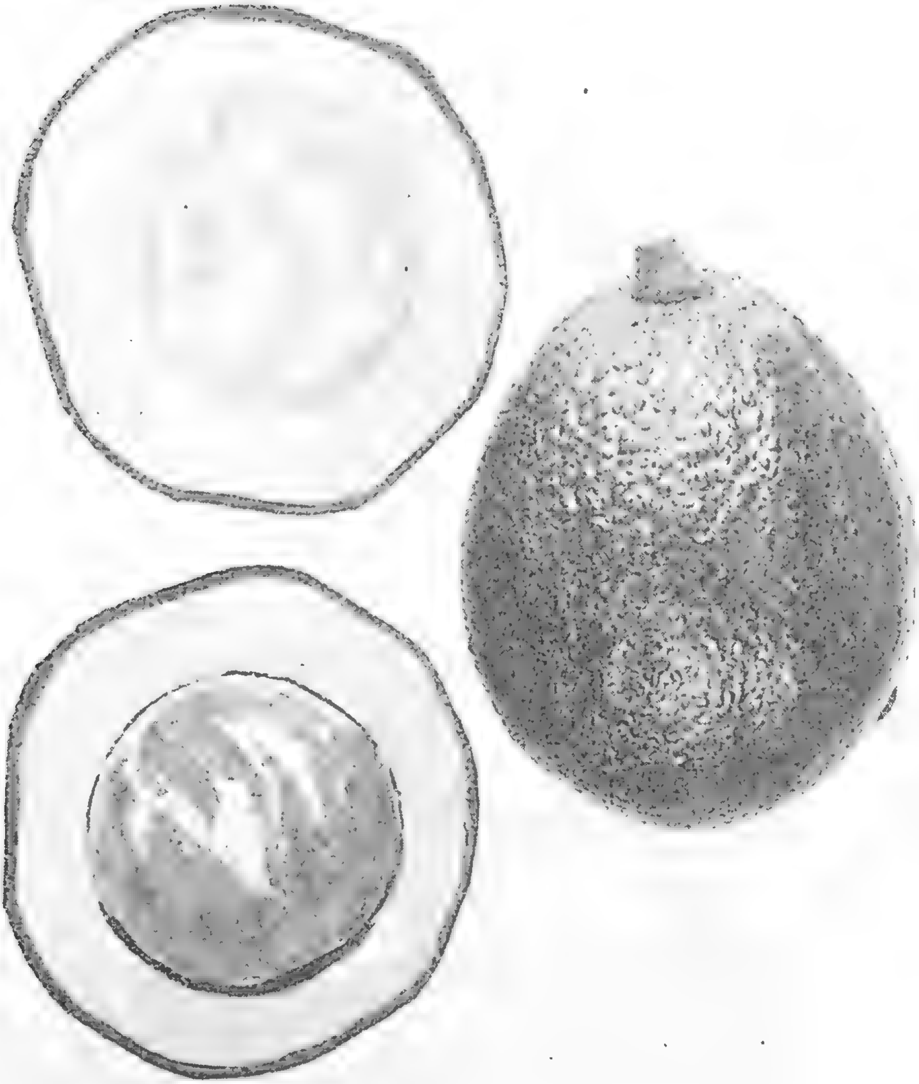

Plate 36.
Avocado Fruit, and Fruit Cut transversely showing Seed in Lower Section.

Avocado cocktail (Six Servings)—

4½ cups sliced avocado.
1 cup tomato catsup.
1 teaspoonful finely-chopped onion or juice.
1½ tablespoonful lemon juice.
½ teaspoonful Worcestershire sauce.
½ teaspoonful salt.

Sprinkle the salt over the avocado and chill; combine the other ingredients, chill and pour over avocado just before serving.

Numerous varieties of avocados have been introduced into Queensland, but many have been discarded for various reasons. Trial plots have been planted, and those varieties which promise to be suitable are being worked and kept under observation. Although at present no definite recommendations can be made, intending planters should confine their selection to such varieties as Grande, Queen, Spinke, Blakeman and Wilsonia, which, from the data available, appear to indicate some measure of suitability for the foothills on the North and South Coast of Queensland.

Sown Pastures and their Management.

C. W. WINDERS, B.Sc.Agr., Assistant Agrostologist.

[*Continued from p. 15, Part 1, Vol. XLVIII.—July,* 1937.]

(Part II.)

PASTURE MIXTURES.

An ideal pasture plant would require, amongst other things, to produce heavily throughout the whole year and to constitute in itself a balanced ration for stock in production. No such plant may be found amongst the common pasture plants, nor, indeed, does any such exist. A near approach to the ideal pasture is attainable in certain areas by sowing a mixture of spring-summer-autumn and autumn-winter-spring growers, clovers or other legumes being blended with grasses.

A word of explanation should be offered here on the value of legumes in mixed pastures. Most dairy farmers and stockraisers know that the major portion of the ration fed to animals should consist of carbohydrates and fats (energy-producing and fat-forming materials), proteins (essential to tissue-building, wool growth, milk production, &c.), and minerals (required for bone formation and other purposes), in proportions which vary with the class of stock fed and the purpose of feeding. In a general way the proportion of proteins to carbohydrates and fats is fairly low in grasses (except in the very young growth) and a pure grass pasture does not provide a properly balanced ration. On the other hand, clovers, lucerne, and other pasture plants belonging to the legume family have a high proportion of proteins to carbohydrates and fats, and these, too, do not form a balanced ration. The requisite proportions of proteins and carbohydrates and fats may be secured in a mixed ration of grasses and legumes, and this is one reason why mixed pastures of grasses and legumes are so desirable. Further, most of the legumes possess a higher proportion of useful minerals than do the grasses and this enchances the feeding value of the mixed pasture generally.

The explanation of the higher protein content of legumes lies in the little growth or nodules which are found on the roots of leguminous plants. Within these nodules occur bacteria which have the power, not possessed by flowering plants, of collecting nitrogen from the air and changing it into a nutrient form. Portion of this transformed nitrogen is taken up by the leguminous plant and built up into proteins, and portion is transferred, either directly or indirectly, to grasses and other non-legumes growing with the legumes. The effect of this supply of nitrogen fertilizing material on grasses is to keep them in a condition of high production (provided other nutrient materials, such as phosphates and potash, are present in the soil in ample quantities), and so the decline in productivity of a pure grass pasture due to rapid depletion of nutrient nitrogen in the soil may be arrested to some extent by incorporating in the pasture a legume which will build up the supply of nutrient nitrogen in the soil by liberating nitrogen taken from the air, and changed into useful nitrogen compounds by the nodule bacteria. Occasionally it is found that lucerne and other legumes when planted on new fertile land in apparently suitable districts do not thrive, and examination shows that the nodules are absent from the roots. In such

cases it is necessary to add the requisite bacteria to the seed before sowing, and cultures of these bacteria are prepared for seed inoculation purposes in most States.

From what has already been written it is obvious that mixtures of grasses and legumes provide a better balanced ration than do pastures composed of a single species, and the legumes assist in maintaining the nitrogen content of the soil.

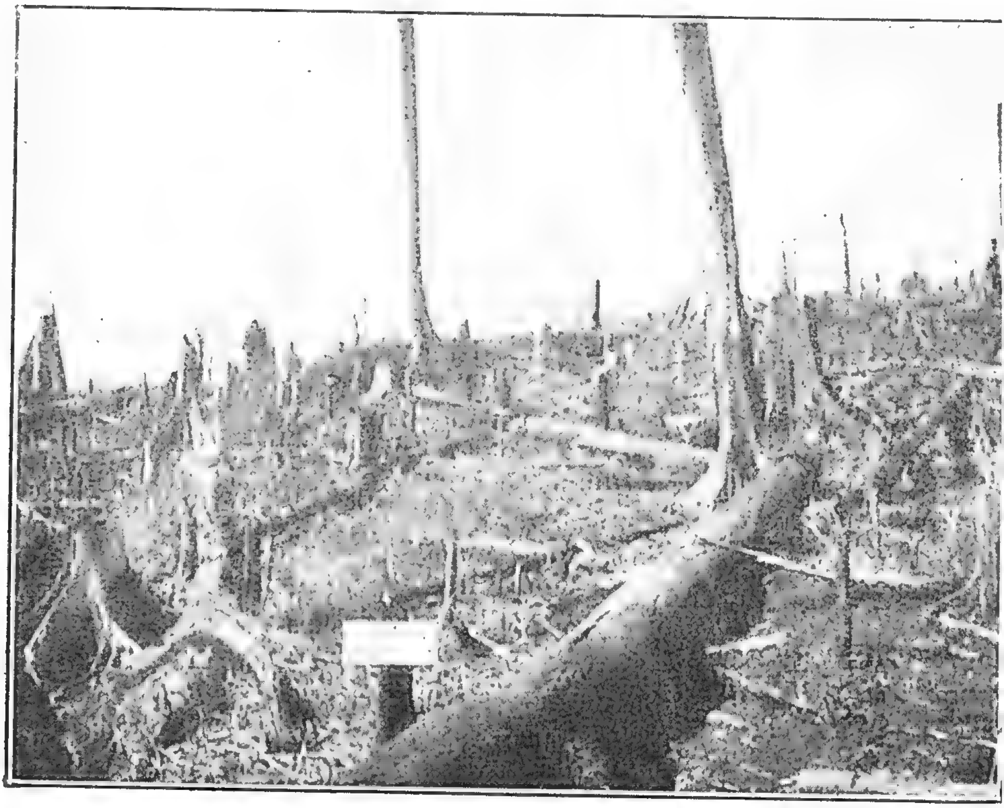

Plate 37.
A freshly-burnt "scrub" area.

Pasture mixtures are desirable also from the point of view of spreading production over the longest possible period of the year. Examples of this are provided by paspalum-white clover pastures (plate 37), where the clover provides grazing during portion of the dormant period of the grass, and by Wimmera ryegrass-lucerne pastures in which the ryegrass is productive during the winter months when the lucerne is at a standstill.

In Queensland, however, the sowing down of mixtures of summer and winter growers is not always successful. Some of our warm season grasses are so aggressive during the wet, summer months that they crowd out most of the pasture plants which are dormant during the warmer period of the year. In addition, the rainfall during the winter months is often too low to permit of the growth of winter-growing pasture plants. However, in some districts the sowing down of winter-growing grasses and clovers in admixture with summer-growing pasture plants is effective in extending the productive period of pasture growth.

On land which varies in soil type from place to place, the sowing down of a mixture of plants is preferable to seeding pure stands, since plants suitable to the different patches are likely to be included in the mixture and a more uniform stand will result.

Simplicity should, however, be the keynote of pasture mixtures. It is usually cheaper, and preferable in most other respects, to sow simple mixtures than to plant complicated mixtures which sooner or later will come to consist of only a few species.

Plate 38.

Sowing Rhodes grass on rotting prickly-pear in brigalow and belah "scrub" in the Maranoa.

SOIL FERTILITY.

A major consideration in the laying down of artificial pastures is the selection of land to be used for the purpose. It is an established fact that pastures make heavy demands upon plant foods contained in the soil, and although a good deal is returned to the soil in the form of animal excreta and plant trash (including decayed roots), much is removed from pasture areas as beef, milk, mutton, wool, &c. Pasture is thus comparable in some respects to harvested crops and, where soil fertility is concerned, should be treated as a crop. In the old agricultural countries, of necessity, pasture has been accorded something approaching crop treatment for years past; but, in Australia, "grass farming" is only now commencing to supersede "grazing" in the more favoured districts.

In view of the high requirements of the better-class pasture plants in respect of foods supplied by the soil, sowings of permanent pastures should be restricted to lands of sufficient fertility to maintain the pastures at a high level of production for several years. As with crop plants, different pasture plants thrive under different degrees of soil fertility. Some demand a very fertile soil; others will tolerate lower fertility conditions. As a general rule, however, the richest soils will produce the best pastures.

Sown pastures are generally established to fulfil one of two conditions, viz:—

(1) To convert virgin timbered country to grazing land within a few months, the settler, pioneering his holding, requiring a cash return within a short period (plates 35 and 36).

(2) To improve timbered, or poorly-grassed, portions of holdings already developed to an appreciable extent, the provision of the improved grazing not being an urgent necessity.

Plate 39.
A mixed paspalum-white clover pasture in the Maleny district.

Where pioneering conditions prevail, the short cut methods of pasture establishment must continue to operate in many instances. Quite apart from the necessity of obtaining pasturage as early as possible, there is justification for the immediate sowing of pasture on freshly-burnt softwood and heavy brigalow scrub areas. Such soils generally are rich in plant foods and the fertility of the land is improved by the addition of ashes from the burnt timber. Moreover, these soils naturally are fairly retentive of moisture. These factors of high initial soil fertility, and abundant moisture content, enable fairly long-lived stands of pasture to be obtained. After some years, however, the initial high fertility of the soil, and its water-absorbing capacity, will have become depleted to some extent and steps will have to be taken, where practicable, to arrest pasture deterioration.

In the case of pasture improvement upon partly-developed properties, a policy of gradually establishing first-class grazing areas should be adopted in preference to one involving the wholesale sowing of

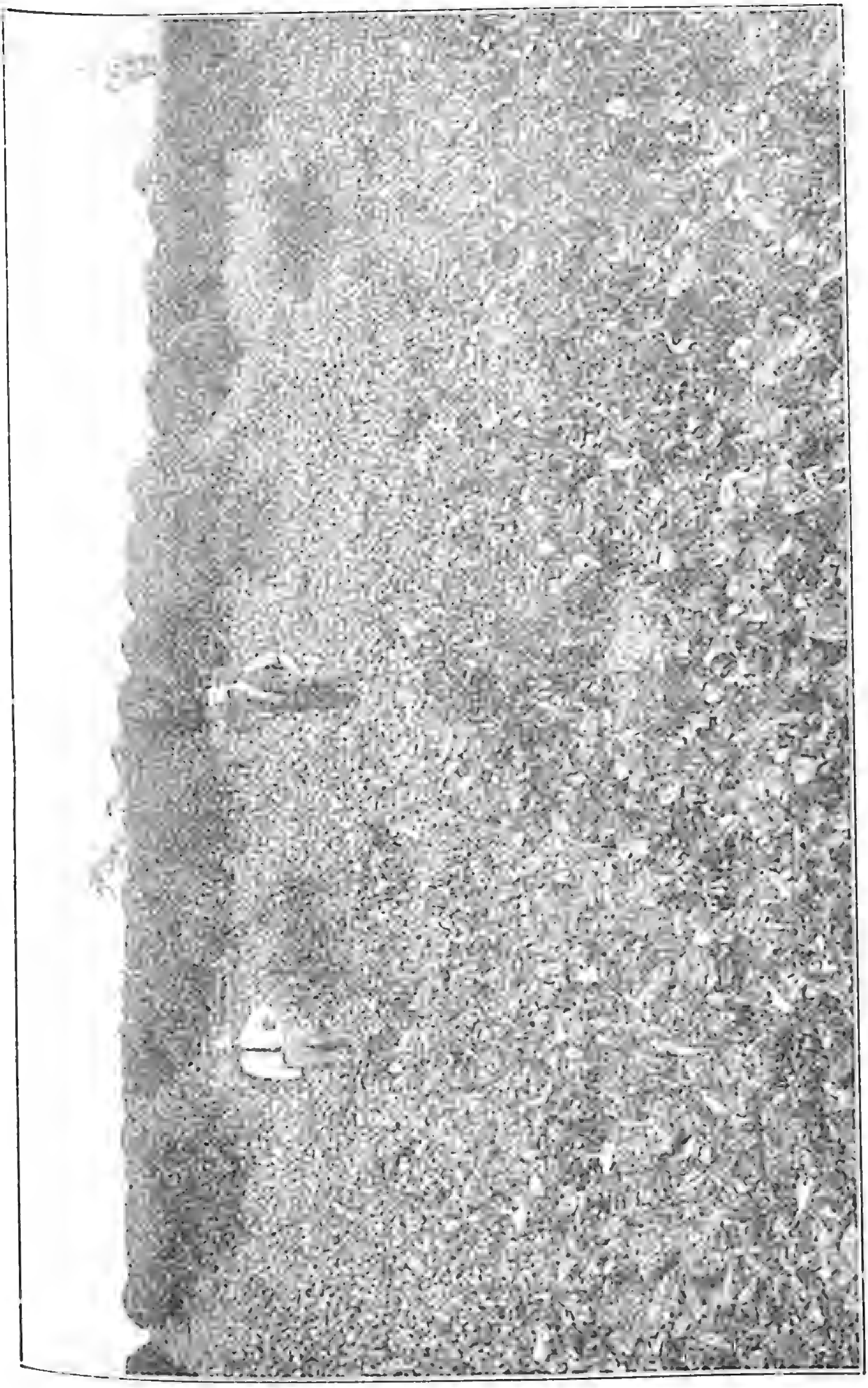

Plate 40.
Cowpeas sown for green manuring purposes.

pastures which will soon become second-class. This applies to the replacement of deteriorated sown and native pastures as well as to the grassing of timbered country. The difference in value between land in first-class condition for pasture, and second-rate land, far outweighs the cost of improving the latter. Naturally, the most fertile areas available on any particular property for pasture sowing should be selected for improvement purposes and the lower class land left alone for the time being. The objective should be efficiently subdivided pastures on fertile, cultivable land which may be cropped and over which a mower may be run.

Methods suitable for bringing various soils into a condition satisfactory for permanent pastures have not yet been worked out in detail for all districts, though much progress has been made in investigations with Rhodes grass pastures at the Callide Cotton Research Station at Biloela. Experience at this centre, and elsewhere, indicates that grass pastures are limited in longevity and productiveness by the supply of available soil nitrates, on which grasses and similar plants are heavy feeders.

The main sources of nitrates in the soil are:—

(*a*) Organic matter, decomposed by the action of certain bacteria with the formation of nitrates, &c., and

(*b*) Nitrogen of the air, converted into nutrient form chiefly by bacteria living in the roots of certain legumes and by a few other bacteria.

The continued production of nitrates from organic matter results eventually in a serious depletion of the organic matter contained in the soil. The effects are a lessened amount of nitrate available to the plants and deterioration in the physical condition of the soil, clay soils setting into hard masses which permit only steady rains to penetrate.

The problem of preparing soils for permanent grass pastures is thus largely one of increasing the nitrate content and the amount of organic matter to a suitable extent. Probably the best means of achieving this are:—

(*a*) Green manuring, both organic matter and available nitrates being increased if a leguminous crop is used for the purpose; (plate 38).

(*b*) Cropping for a certain period with a leguminous cash or fodder crop, such as lucerne or clovers, the nitrate content being increased by the activity of the root-infesting bacteria and the dead roots adding organic matter; and

(*c*) Growing of a row crop demanding relatively little nitrate, the intense cultivation of the soil stimulating the production of nitrates from organic matter already in the soil.

The exact methods that should be adopted have yet to be elaborated for different conditions, but sufficient has been written to indicate that soil fertility is a major consideration in the laying down of pastures.

PREPARATION OF SEED-BED.

Different types of seedbed, varying from uncultivated forest land to the onion-bed type, are employed for sown pastures. The seedbed provided by uncleared forest land, even if some harrowing has been

Plate [illegible]

The fiddle type of seed sower.

carried out, is quite unsuited for pasture establishment. In addition to the fairly low fertility of the land usually found, the competition of native grasses and undergrowth prevents the satisfactory establishment of sown species. Likewise, established pastures of native or other grasses are not receptive of additional pasture plants unless a disturbed seedbed is provided and a temporary check given to the growth of the established plants by severe harrowing. Under certain conditions wood ashes on burnt-over areas form quite a good seedbed.

Plate 42.
A popular type of hand-operated seed broadcasting machine.

By far the best seedbed is that resulting from the efficient tillage of fertile soil. Most of the common pasture plants have small seeds and require a seedbed of fine tilth. By compacting the soil close to the surface a seedbed is provided which is favourable to the fine, early

root systems of the pasture plants. The seedbed should also be provided with ample moisture and in dry districts, particularly, cultural operations throughout the seedbed preparation period should be carried out with due regard to the conservation of moisture. Ploughing well in advance of sowing is desirable, and the land should be allowed to lie in the rough state for a few weeks before further cultivation is undertaken. Heavy peg harrows or a springtooth cultivator will be required to break down the clods. Subsequent working should aim at destroying weeds and compacting the sub-surface soil, and shallow harrowings with the peg harrow or springtooth will assist in this direction. If the land becomes weedy and the surface sets hard, a disc harrow may be necessary to destroy the weeds. Rolling prior to sowing may be desirable in cases where the ordinary cultivation has not sufficed to form a fine seedbed.

If a pasture is to be established from cuttings, plantlets or crown divisions there is not the same necessity for compacting the soil, though moisture conservation, weed destruction and the avoidance of a loose, spongy soil condition are desirable. Under special circumstances the planting of vegetative material may be carried out on rough, and on timbered country, with some prospects of successful establishment, but wherever possible well-worked land should be provided.

METHODS OF SOWING AND PLANTING.

Whilst hand-broadcasting is still the commonest means of sowing pasture seeds in Queensland, the adaptation of drills and manure spreaders for the purpose is now being exploited. Broadcasting seed by hand (plate 36) is fairly satisfactory when carried out on a still day, provided that separate sowings are made of grass seeds and of "shotty" seeds such as those of lucerne and clovers. Hand-broadcasting is the most practicable method of sowing such seeds as those of Rhodes grass and molasses grass. Sometimes it is advisable to mix the seeds with superphosphate or with sand in order to secure a uniform stand. Special hand-operated broadcasting machines (plates 39 and 40) are useful for certain seeds.

Special pasture seed attachments are obtainable for fitting to cereal drills, but are not recommended for use with grass seeds which bunch together. Where the special lucerne and grass seeder is not fitted, pasture seeds of suitable type may be sown through the fertiliser box of the ordinary cereal seed drill. The seed must, however, be mixed with fertiliser or sand, and the mixture constantly agitated. When a drill is used for sowing pasture seeds the discs or hoes should be adjusted to run very shallowly or even along the surface of the land, otherwise the seed will be buried too deeply. Sowing in drills is more economical of seed than is broadcasting.

Manure spreaders can also be utilised for distributing pasture seeds. Where seed is being sown in admixture with fertiliser certain precautions should be taken in order that the viability of the seed may remain unimpaired. Seed should not be placed in close contact with moist fertilisers, and when mixed with dry materials, such as superphosphate, should be sown within a day or two of mixing.

Whilst some seeds may be sown on the surface of the soil and allowed to become buried by natural means, it is generally advisable to cover the seeds immediately after sowing. In addition to bringing the seeds into close contact with the moist soil, covering protects the

seed from destruction by birds and ants. In covering small seeds, care must be taken that they are not buried deeper than about one-half inch below the surface of the compacted soil, otherwise the tender shoots may not be able to push through to the surface. If the loose surface mulch is shallow a light rolling or harrowing with light peg or brush harrows is effective in covering the seed, but where the compacted layer is deeper a long-toothed harrow may be necessary. If the surface mulch is too fine and cakes after rain only a very light covering should be given to the seeds. Except on soils which cake on rolling, a light rolling after sowing is often useful in compacting the soil about the seeds. If the soil is somewhat dry a harrowing should precede the rolling. On sheep properties a fairly common method of covering pasture seeds sown on the surface is to run a big mob of sheep over the paddock to trample under the seed, but the stock should not be allowed on the area long enough to consolidate the soil.

Various methods are adopted for planting cuttings, crown divisions or plantlets. The planting material may be "dibbled in" (that is, placed in a hole made with a sharp stick, a hoe or a mattock) or planted in furrows on cultivated land. Whatever type of material is used, the soil must be firmed around the sett by tramping or rolling. Cuttings strike at the joints and should be planted so that at least one joint is below the surface of the soil. The method recommended in South Africa* for planting plantlets and pieces of tufts of plants is as follows: The plants are set out in holes in lines across the field. The holes are made by means of a hoe, the operator walking along the line and making a hole at each step. The correct method of hoeing is to use the hoe with its head at right angles to the line. In planting, the planter works along the line, places the plant against the hard far edge of the hole, fills up the hole and compacts the soil with all his weight on his right foot while putting in the next plant. To avoid setting the plants too deeply the grass should be held from above, but close to the crown, so that the knuckles of the hand are on top of the ground when the plant is being set.

PASTURE MANAGEMENT.

General Principles.

The aims of pasture management are twofold: first to increase the carrying capacity of the pasture to its maximum, and to maintain it at that level; and secondly, to prevent the pasture from deteriorating and, if possible, to improve it. These two aims should be pursued concurrently. The production of animal products, such as wool, mutton, beef, milk or cream should not be made at the expense of the quality of the pasture. The system of pasture management followed should be such as to give due recognition to the demands of both the stock and the pastures.

What is known as the "intensive system of pasture management" embodies all the refinements of good grazing practice, but some modifications are necessary in Queensland. The intensive system, which was evolved in Germany during the great war, employs scientific methods of feeding pasture to stock. The object is systematically to feed off the pasture at the stage of maximum food value, and to accomplish this it is necessary to concentrate stock upon the pastures at many times the normal rate, for periods correspondingly shortened for each paddock.

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* J. A. Pentz: "South African Pasture Grasses together with a Survey of the Work on Prinohof Pasture Experiment Station." Bul. No. 148 of the Union of South Africa Department of Agriculture and Forestry.

This necessitates the provision of a number of paddocks and their rotational grazing. On dairy farms in those countries where, because of regular and uniform rainfall, it is possible to adhere to an orderly plan of rotation, it is usual either to follow the milkers with dry cattle to clean up any rough herbage or to level the rough grass by mowing. Other important aspects of the system are the conservation of the surplus grass produced in the flush of the year, harrowing after grazing to distribute dung, renovating to reinvigorate the pasture, and systematic topdressing with phosphatic, nitrogenous, and potassic manures.

Subdivision of Paddocks.

On many dairy farms it is usual to find a small number of large paddocks rather than a large number of small paddocks. The typical pasture conditions on such farms may be attributed to the lack of sufficient subdividing fences to permit of proper grazing management. Under the existing conditions of poorly controlled grazing the pastures, during the flush of their growth, consist characteristically of a series of closely grazed patches interspersed with rank growth which either is not eaten at all or is left until the following autumn or winter, by which time it has deteriorated greatly in food value. Often more than one-half of the pasture, towards the end of the main growing season, consists of untouched rank growth, and it therefore is easy to visualise the large amount of waste that occurs. (The ultimate fate of this excess growth, provided it is not burnt, is to build up the organic matter in the soil, and it is, therefore, not entirely wasted. The practice of adding organic matter, however, is much more effective if undertaken systematically rather than in a haphazard way.) The uneven grazing arises from the cow's preference for the short, leafy grass, which is usually more palatable and nutritious than the same grass when it has become rank and stemmy. When a cow is turned into a paddock which supplies a superabundance of feed she will graze the pasture in patches and will return again and again to these patches, neglecting the overgrown clumps. A similar state of affairs is observed on grazing properties of all descriptions.

As the first step towards keeping the pasture at the short, leafy stage, and ensuring the even grazing of a mixed pasture, it is necessary to provide a series of relatively small paddocks which may be grazed at will according to the stage of growth, infestation by disease, or other conditions. The extent of subdivision desirable depends on a number of factors, including the type of pasture, the class of stock, the size of the herd or flock and others. In all cases where intensive or semi-intensive production of livestock or livestock products is aimed at (i.e., on dairying, fat lamb, and beef fattening properties), greater returns may be expected from subdividing the better-class portions of the holding than from cutting up the inferior areas into small paddocks. First attention, therefore, should be given to the most productive areas.

Care must be exercised in planning the layout of the paddocks in order to provide for the most convenient movement of the stock and their easy access to water. When subdividing paddocks it is generally unnecessary to erect the same type of fence as is used on the boundary lines. Something better than the usual type of temporary fence is, however, required. Only one type of pasture should be included in each paddock. If one area of poor pasture and another of better pasture

occur in the one paddock the stock will neglect the inferior grass and concentrate upon the good pasture, to the detriment of the paddock as a whole. A similar distinction is shown in paddocks which have not been uniformly topdressed.

Rotational Grazing.

Since the object of securing a high measure of control of the grazing is to provide the short bite in a systematic manner, the pasture should not be allowed to grow rank, unpalatable and lacking in nutrition before being grazed. Usually a heavy concentration of stock for a few days on a paddock carrying young pasture, generally less than 12 inches tall, will clean the pasture up to the best advantage. When the pasture has been eaten down fairly closely the stock should be removed to another paddock and the eaten-down pasture permitted to develop a fresh growth before being again grazed. If a fresh young bite is to be available to the stock during most of the growing season of the pasture a fairly large number of paddocks will be necessary. Even on dairy farms in the districts most favoured by rainfall at least six paddocks should be provided.

The conception of grazing paddocks to a predetermined plan of rotation is generally inapplicable to Queensland conditions, but the purpose is served if each paddock is submitted to short and intermittent grazings rather than being grazed for long periods without interruption.

As a general rule, the young growth available in the small paddocks should be reserved for stock in production. If these do not graze the area evenly, dry and non-producing animals may be brought in to clean up the irregularities, or the mower may be used. Patches of long grass allowed to remain in the paddock will reduce the area of short, young pasture available during the next grazing period.

On well-subdivided farms, during the flush of the season, when it is difficult to keep the grass fed down, one or more of the paddocks could be shut up and the grass allowed to grow to the hay or silage stage when it might be mown for conservation.

Special care must be exercised in grazing pastures containing a high proportion of succulent legumes and clovers. Hungry ruminants ingesting a large quantity of succulent feed are apt to become "blown"; consequently, stock should be allowed on to legume-rich pastures for only fifteen to twenty minutes at a time, or they should not be put on until they are half full of grass or roughage.

Spreading Animal Droppings.

A paddock after being grazed has a scattering of droppings over its surface; but the extent to which the pasture can be benefited by distributing this manure before it becomes too hard is realised by too few farmers and graziers. The dung contains a fair proportion of the original food value of the grass and, if a dropping is allowed to lie undisturbed, the plant foods contained therein will lead to a rank growth of grass in that particular spot. This rank, patchy growth is not liked by stock, and if full advantage is to be taken of the manure available, the fertilizing ingredients must be more uniformly spread over the paddock. Distribution can be carried out by means of a special pasture harrow, or by running over the area an ordinary peg harrow

about which several lengths of barbed wire are loosely coiled. A weatherboard or other type of timber drag is quite satisfactory, but its use on wet dung in dry weather should be avoided in order to prevent the fouling of the pasture by extensive smearing.

Mechanical Treatment of Pastures.

In many countries the mechanical treatment of certain types of pastures has long been a feature of efficient pasture management. In Queensland the value of the practice in renovating paspalum pastures has been demonstrated, but so far little has been discovered in regard to its effects on other pasture types.

In the sod type of grass pasture, conditions unfavourable to maximum pasture growth commence to develop once the sward is well established. The complete covering given to the soil by the pasture in many instances acts as a thatch which diverts rain water from the surface and prevents its penetration into the soil. This effect is pronounced where storm rains, and not steady, soaking falls, are experienced. In neglected pastures (perhaps partly as a result of droughty conditions caused by poor moisture penetration) old and dead roots accumulate in the upper layer of the soil and interfere with the development of young roots and with the aeration of the soil. A reduction in the productivity of the pasture is the general result of the conditions described, and their amelioration is largely a matter of breaking up the matted grass and the few inches of soil at the top.

The implements used for this purpose are varied and include the plough, the rotary hoe, special tine cultivators, &c. Further details are given under the sections dealing with the individual pasture plants.

Lime and Fertilizer Treatments.

The establishment and the maintenance of productive pastures depend to a large extent upon the degree of soil acidity and the amounts of available plant foods in the soil. Different pasture plants have different requirements in regard to both soil acidity and soil nutrients, but most sown pastures may be improved by attention to one or the other of these factors or both.

The degree of soil acidity may conveniently be expressed numerically by what is known as the pH value. A soil neither acid nor alkaline in nature has a pH value of 7; values from 7 down to 0 constitute the acid range; whereas values from 7 to 14 comprise the alkaline range. Most soils have pH values between 4 and 8. Soils of pH 0 to 4·7 may be regarded as very strongly acid; soils of pH 4·7 to 5·2 as strongly acid; those of pH 5·2 to 5·8 as of medium acidity, of pH 5·8 to 6·4 as moderately acid, and of pH 6·4 to 7·0 as slightly acid. Slightly alkaline soils range from 7·0 to 7·5, soils of medium alkalinity from pH 7·5 to 8·2, and strongly alkaline soils greater than pH 8·2. According to the National Fertilizer Association of the U.S.A. the most suitable pH ranges for various pasture plants are as follows:—lucerne, 6·5 to 7·5; red clover, 6·0 to 7·0; white clover, 6·0 to 7·0; barley, 5·5 to 7·0; wheat, 5·5 to 7·0; cowpeas, 5·5 to 7·0; grasses, 5·5 to 7·0; lespedeza, 5·5 to 7·0; oats, 5·5 to 7·0; velvet bean, 5·5 to 6·5; and vetch, 5·5 to 6·5.

In a general way, soil acidity is related to rainfall conditions, the wet coastal areas having more acid soils than the drier inland areas.

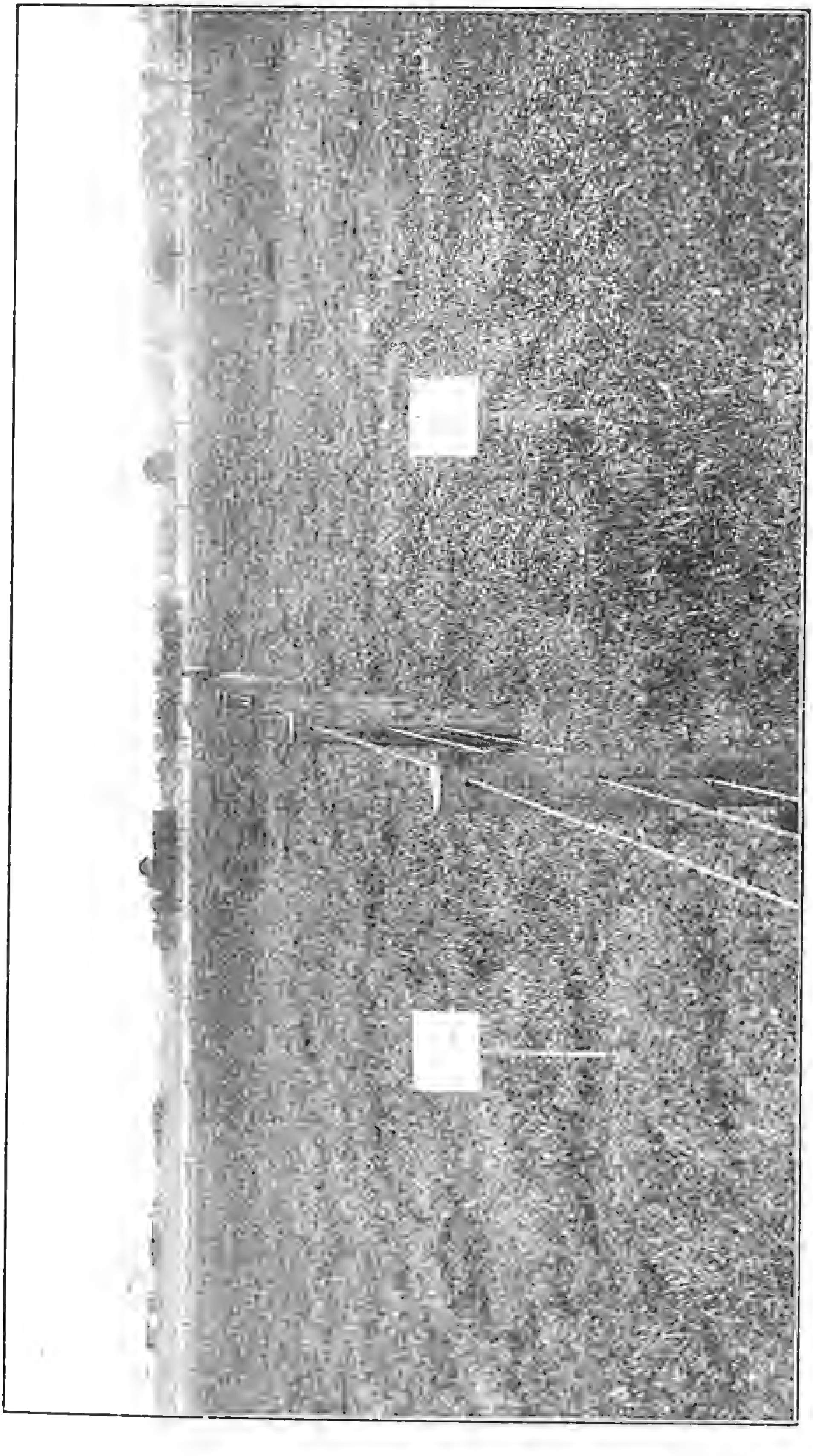

Plate 43.

Adjacent [illegible] Paddocks on an East Moreton Dairy Farm.—The clover-rich paddock on the right was treated with a mixed fertilizer; that on the left was not fertilized.

In the wet Babinda area cane soils of pH 3·8 to 5·4 are common; some of the Atherton Tableland pasture soils have a pH as low as 5·2; black soils in the Callide, Lockyer and other river valleys are alkaline in nature, as are the pasture soils of the west. The poor development of legumes in the coastal cultivated pastures may be bound up with acid soil conditions; certainly the reduction of acidity by applications of lime has increased the clover content in many instances. Where the soil is shown by an acidity test to be strongly acid, the effects of the applications of lime should be tried. The amount of lime which must be added to a soil to reduce its acidity by one or more units of pH depends upon the soil type and, until our experience has been increased, the amount of lime to be added can only be roughly gauged. Lime for agricultural purposes is on the market in a number of forms of widely varying agricultural value, and those interested in the subject should procure a copy of a pamphlet entitled "Lime for Agricultural Purposes" from the Department of Agriculture and Stock before purchasing their requirements.

Whilst a certain amount of experimental work in connection with the top-dressing of Queensland pastures has been carried out, the exact place of fertilizers in pasture management and improvement is by no means clear. In some districts the problem is complicated by the effect of soil acidity and other soil characteristics on the availability of applied fertilizers and much investigational work is required in these areas. One of the chief effects of certain fertilizers on temperate pastures—viz., the encouragement of clovers and other legumes—is nullified to some extent in many Queensland areas because of the general unsuitability of climatic conditions to the growth of useful pasture legumes. A third disturbing factor is the uncertainty of the rainfall, and a fourth lies in the poor condition of matted pastures for the reception of added fertilizers.

In spite of the difficulties mentioned, a certain amount of pasture is successfully treated with fertilizers (plate 41) and it is fairly obvious that the practice must eventually become a regular feature of pasture management, at least in certain areas. The plant foods usually employed in fertilizers for stimulating pasture production are phosphate and nitrogen. The special effects of phosphatic fertilizers on pastures are the encouragement of root development in the seedlings and of legume growth. Nitrogenous fertilizers are especially valuable in promoting the leaf growth of grasses. Both kinds of materials increase palatability, feeding value and general productivity of pastures.

There are several methods of applying lime and fertilizers to pasture land. Hand-broadcasting from a bucket or bag is very tedious work and, on a windy day, unpleasant, but where small areas are being top-dressed it is the method commonly employed. An alternative means of top-dressing small areas is to employ a knapsack fertilizer broadcaster, of which several makes are available. For top-dressing large areas, specially designed machines are on the market. These are of two general types, namely, spreaders, and broadcasters.

The general form of broadcaster is a hopper fitted with a distributor disc designed to be driven from the wheel of the cart or lorry on which

the hopper is intended to be mounted. (This type of broadcaster can also be obtained mounted on its own chassis.) The fertilizer is thrown to both sides of the machine by the revolving distributor disc. Even distribution and regular cover are somewhat difficult to obtain because of the influence of wind on the cast and the difficulty of driving to the line of the throw of the previous round. On rough country, however, these machines are very useful.

The fertilizer spreader is a self-contained machine. The fertilizer is released from the box by the movements of a "star" feed, or of an endless chain, and drops directly to the ground. An alternative machine to the special spreader is the ordinary wheat drill, but the draught of the latter is considerable when compared with that of the light spreader.

Where both lime and superphosphate are to be applied to a pasture, the application of the former should precede that of the superphosphate by as long a period as is possible. If the two substances are applied simultaneously the lime may cause portion of the superphosphate to revert from the useful water-soluble form to the less readily available citric acid soluble form.

Burning of Pastures.

The burning of paspalum, Rhodes grass and other cultivated pastures with the objects of getting rid of accumulated trash and coarse, dry material, and of encouraging the production of an early "bite" in the spring, is quite common in Queensland. Insufficient information is available to indicate precisely what is the effect of burning on such pastures, but there is no doubt that firing results in the destruction of a large amount of organic matter and probably has other harmful effects if regularly carried out. There is much to be said in favour of the view that the benefits obtainable from burning could be secured with fewer harmful effects by the adoption of a system of pasture management involving intermittent heavy grazing, the use of the mower, and the harrowing of the pastures.

Miscellaneous Aspects of Pasture Management.

Suitable shade should be provided for the stock in hot weather and shelters for their protection during cold weather. The location of these resting places should be chosen with a thought to the conservation of the animals' excreta. If the paddock slopes to a stream the animals should be encouraged to rest near the top of the slope, since, if they camp along the watercourses, heavy rains will wash the droppings away and remove a large amount of fertilizing material which otherwise could be retained on the pasture areas.

The several classes of livestock have different grazing habits and a proper appreciation of these habits will enable a much better utilisation of the pasture resources on a property to be achieved. Cattle are perhaps the most efficient grazers, inasmuch as they graze more uniformly than other classes of livestock. Sheep are more selective in their grazing, paying the greatest attention to the finer constituents of the pasture and neglecting the coarser plants. Horse paddocks usually deteriorate much more rapidly than other pastures, the horses allowing the coarser grasses to increase by neglecting them in favour of the fine grasses, which

are eventually eaten out altogether. Sheep and goats eat some weeds and shrubs more readily than larger stock, and so are useful on dairy farms for cleaning up weedy pastures.

For most types of pasture it is found that most efficient grazing is attained by carrying two or three classes of livestock, but this is not always practicable. Pastures in parts of the Maranoa and Darling Downs, many of which are used for sheep-raising, require after an exceptionally favourable period of rainfall to be eaten off by cattle before the sheep can make good use of them.

[TO BE CONTINUED.]

PIGMENTS IN MILK.

Milk contains two kinds of colouring substances, one of which is soluble in water, and the other soluble in butterfat. The water soluble pigment is called lactochrome and its greenish-yellow colour may always be seen in whey during cheese manufacture. The pigment soluble in fat is yellow in colour, and is more interesting and important on account of its presence in butter. It is called carotin, and belongs to a group of colouring substances called carotinoids, which are widely distributed in plants and are also found in many animals. Carotin for example is also responsible for the yellowish colour of the fatty tissue and skin secretion of dairy cattle, especially Jerseys and Guernseys. Another carotinoid, which is very closely related to carotin and which is called lycopin, causes the red colour of tomatoes, watermelons, and other fruits, but has not been found to occur in animals or milk.

Carotin is found in all green plants, being manufactured by the plants themselves, but it is not manufactured in the body of animals. The presence of carotin in milk fat is therefore due to a direct transfer of this colouring substance from the food eaten by the cow.

This has been proved quite definitely by feeding experiments, which have shown that the amount of carotin in the fat increases or decreases, according to the amount of carotin present in the food. When cows are fed on such foods as cottonseed meal, timothy hay, white corn and yellow corn, the amount of carotin found in milk fat is very low compared with that obtained from cows fed on green lucerne hay, green crops, fresh pasture grass, and similar foods.

This offers an explanation of the seasonal variation in the natural colour of butter, and also indicates why butter from some districts is more yellow than butter from other districts. In those areas with a good annual rainfall and consequently a plentiful supply of green pasture, the colour of butter is always brighter than that produced in the drier parts of the State.

The various breeds of dairy cattle differ with respect to the amount of this yellow colouring substance in butter fat. Guernseys and Jerseys rank first in this respect, with Ayrshires, Shorthorns and Friesians lower down on the scale. Another interesting feature about this pigment is that, of all the animals whose milk is commonly used for human food, cows alone give milk which has a pronounced yellow colouration of the fat. Milk fat from the goat, ewe, camel, and water buffalo is almost entirely devoid of yellow colouring matter. The fat of human milk, however, is at times distinctly tinted by carotinoids. The reasons why such differences occur is not known.

A point of great interest and importance also is the relationship between carotin and vitamins in milk and butter. It has been shown that carotin can be transformed into vitamin A by the cow itself. The yellow colour of butter such as is often seen in spring and summer-time, is therefore suggestive of richness in vitamins, and vitamin content is one of the best arguments for butter as a fatty food for children and adults.

O. St. J. Kent.

Sheep Grazing at the Mackay Experiment Station.*

D. L. McBRYDE.

THE necessity for diverting cane lands from the production of "excess" sugar into more profitable channels has been considered carefully by the Bureau, and canegrowers will probably be interested in the experiment which was undertaken at the Mackay Sugar Experiment Station, Te Kowai, during the spring of 1936. It marks an attempt to determine the value of the Mackay lands for pasture production, in a project which aims at breeding suitable types of cross-bred lambs, and fattening them for the market. The Minister for Agriculture and Stock (Hon. F. W. Bulcock) was closely associated with the initiation of the plan, and we are indebted to the Minister for his sustained interest and assistance in the work.

A block of 16 acres, situated on the poorest and wettest portion of the experiment station, was selected for the purpose, so that the tests are being conducted under rigorous conditions. The block has been subdivided into 8 sections, each 2 acres in area. When the rotation has been established, one section will be under plant cane, one under first ratoons, and the balance in grass, or in process of preparation for pasture or cane. The eight plots will thus have produced two crops of cane in the eight years of the rotation. The object of the trial is thus twofold—firstly, to produce cane, and, secondly, to devote the land to some profitable form of grazing while its fertility is being built up under pasture. The latter phase will be assisted still further by the judicious sowing and ploughing under, or feeding off, of leguminous crops.

At the present time four sections (about 8 acres) are fenced off as a grazing area. Here grasses are very well established—mainly *Panicum muticum* and Guinea grass. Portion of the present grazing area carries a rank growth of these species, while the balance was cut or burned off during 1936. The standover grass is too heavy and thick to permit the sheep to travel through it, and it will be burned off as soon as conditions will permit. Even the new growth grew so rapidly that the sheep were forced to keep to the tracks which they had beaten through it. This has since been mown to improve conditions.

The area is very wet and attention is being paid to the improvement of drainage conditions. Twice in recent months the entire paddock has been inundated by flood waters. On the first occasion twelve inches of water stood on the block for about twelve hours, while again in March there were several inches of water in all parts of the paddock for three days. This second flooding came at the conclusion of a wet period of about two weeks, during which the coats of the sheep were continuously saturated by the showery conditions.

Twenty-five ewes, 2-, 4-, and 6-tooths, were chosen from the flock of Mr. J. Jones, North Eton, for the purpose of the experiment. These animals are Merino-Corriedales, which were bred and reared on the Eton property. The ram is a stud animal, of the Romney Marsh breed, which was despatched from Southern Queensland to run with the ewes.

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* In *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations), July, 1937.

Plate 44.
Flock of Merino-Corriedale ewes at Mackay Experiment Station.

Despite the trying conditions which the sheep have passed through, recent inspection by Veterinary Officer Irving, of Rockhampton, proved that there was no sign of foot-rot, worms, or fly-blowing in the mob, and that all the animals were in excellent condition and quite normal in all respects.

The accompanying photographs were taken early in April, 1937.

Plate 45.
Romney Marsh ram at the Mackay Experiment Station.

Common Milk and Cream Taints.

M. J. GRIFFITHS, B.Sc. (Dairying), Dairy Research Laboratory.

THE causes of undesirable or "off" flavours in milk and cream may be broadly grouped into—

A. Bacterial taints,

B. Those due to physiological disturbance,

C. Feed flavours,

D. Those due to traces of metals,

E. Absorbed flavours,

although it does not follow that one fault is always due to the same cause. Bitterness, for instance, may be either physiological, bacterial, or a feed taint.

Unclean or "Cowy" Odours.

Bacteria common in the cow-shed, present in manure, and carried about on dried dust particles in the atmosphere, on the cows' coats, and by milk utensils, are responsible for the unpleasant smell and taste variously described as "farmyard," "cowy," or "unclean," which is followed by souring with gassiness. These are not found in carefully produced milk and cream where conditions are hygenic.

Soapy Flavour.

Overneutralising of cream (or milk) may result in soapiness, which is actually a combination of part of the fat present with the alkaline neutraliser. In rare cases it is caused by an ammonia-forming group of bacteria, and it may show up in cooled milk when the normal souring group is not active.

Bitter Flavour.

There are several causes of bitterness developing in milk and cream. It may be due to a type of yeast, or to bacteria, usually of the spore-forming type, capable of breaking down the protein into bitter-tasting substances—this often occurs in pasteurised milk and cream where the normal acid-forming types have been destroyed.

Certain feeds, notably thistles, lupins, and vetches, if fed shortly before milking, have been found to produce a bitter taint in milk, the essential oils passing through from the blood stream unchanged. If it is possible to prevent the cow from consuming these feeds within three to four hours of milking, these substances have time to be dealt with by the body and are not secreted in the milk.

Mastitis Milk.

Both bitter and salty tastes result from the udder inflammation known as mastitis, mammitis, or garget. In the early stages, mastitis milk may be difficult to detect and separate from the rest, unless the first-drawn milk is carefully examined, when minute clots may be detected. Cream separated from mastitis milk has a flat, disagreeable flavour, due to the absence of normal acid-formation. Mastitis milk is unsuitable for cheese-making or for consumption, though it may be possible, if the infection is only slight, to pasteurise and use it for stock-feeding.

Late Lactation Milk.

Saltiness is also met with in milk from cows well advanced in lactation. The salt content of milk is a very variable quantity and reacts to any physical abnormality. Towards the end of the lactation period a large proportion of the potassium and phosphates are being used up in nourishing the young calf and are not secreted in the milk, so that the sodium chloride is proportionally greater. A rise in the chlorine content, which often accompanies advanced lactation, and an alteration in the chemical composition of the fat which sometimes occurs—giving an impression of rancidity—contribute to the unpleasant, salty, bitter, or rancid flavours frequently found in such milk.

Colostrum Milk.

The milk of newly-calved cows, known as colostrum, differs completely in colour, flavour, and composition from that obtained a week after calving. It is a viscous substance, with a sickly taste, and unfit for any dairy uses, while the cream separated from it is unsuitable for buttermaking—the fat is not identical with milk fat, and its taste is disagreeable. A comparison of the approximate composition of colostrum with that of milk shows its essential difference.

	Colostrum. Per cent.	Milk after 7 days. Per cent.
Fat	3·4	3·9
Sugar	2·5	5·1
Casein	4·8	2·5
Albumen } Globulin }	15·8	·7
Ash	1·8	·7
Water	71·7	87·1

The large proportion of albumen and globulin causes coagulation to take place on heating colostrum. Seven days should be allowed before the milk is used for any purpose other than calf-feeding—the substances contained in colostrum being specially adapted for the needs of the new-born calf.

The practice of including colostrum milk or cream with the bulk supply results in a loss of quality and a grading down of the whole delivery.

Disinfectant Flavour.

The use of strong chemicals for disinfecting purposes in the milking shed or dairy often results in a tainting of the milk and cream. Carbolic compounds should always be avoided. Potassium permanganate and lime may be used safely in the cow-shed. For other dairy purposes—such as water treatment, and disinfecting tanks—chlorine compounds are effective in action. Care should be taken, however, to make certain that the strength of the disinfectant solution is correct—chlorine has enormous germicidal power (·5 parts per million of free chlorine is efficient in sterilizing water) and it is often used in far too great a concentration, when, besides being uneconomical, it is liable to produce a serious off-flavour.

Oily, Tallowy, or Sunlight Taint.

Certain metals, notably copper and iron, when absorbed by milk and cream, are the cause of chemical changes in the fat which give a taste described as "oily," "tallowy," or "cardboard." This taint develops rapidly in the presence of air and direct sunlight, and cannot be removed. Often, a cooler or pipe from which the tinning has worn

off, exposing a copper surface, will taint large amounts of milk, the taint developing after a longer or shorter time, according to conditions. In the same way, cream placed in rusty cans will take up considerable quantities of iron. In the warm state, milk and cream absorb metals more quickly, so that the retinning of worn utensils, especially cream cans which have become rusty, and coolers, should be done regularly. This is not a bacterial taint, and will develop in well-cooled and cold-stored milk and cream.

Other Absorbed Flavours.

Kerosene, petrol, smoke, engine exhaust fumes, paint, tar, and other strong-smelling substances produce taints in milk and cream, which readily absorb the odours from their immediate surroundings. Similarly, in the home, the flavour of other foods stored near milk, cream, or butter, such as fruit, onions, fish, &c., will be taken up by the milk fat in a very short time. Dairy products should, therefore, be stored well away from substances likely to impart a foreign flavour to them.

Control of Taints.

The control of most of these taints lies with the farmer, and on the care that he gives to his work depends the good quality of the finished dairy product. Bacterial off-flavours are only prevented by careful production methods and attention to cleanliness at all stages, and nothing can take the place of thorough washing, followed up by sterilization of all the equipment used.

It is important to remember that when once taints have become established in milk or cream on the farm, no subsequent treatment by the factory can be effective in removing them completely.

PREVENTION OF DISEASE IN PIGS.

By the general practice of hygiene and sanitation in the piggery, coupled with sound feeding methods, the incidence of most pig diseases can be considerably reduced.

The provision of roomy, well ventilated, but draught-proof sties is essential.

The floors should be swept clean every morning, all refuse being taken away and the yards raked over. Correct drainage of sties and yards will avoid the accumulation of water and help to keep down insanitary conditions.

Moisture is necessary for the free living stages of nearly all worm parasites and in its absence very few of them can survive for any length of time. Therefore, pig keepers who wish to avoid losses from worms must have dry, well-drained sties and yards.

Unhygienic and insanitary conditions are predisposing causes of rheumatism, catarrh, and some of the more serious bacterial infections, such as suppurative otitis and pneumonia. Piggeries should therefore be constructed on high ground: floors should be made of concrete and the run should be well sheltered from inclement weather.

Proper feeding is also essential for the maintenance of health in pigs. The food should be wholesome and must be supplied at regular intervals in proper quantities. Regularity in feeding induces better digestion. If the animals are properly fed, there is little likelihood of any food being left over. Stomach and bowel troubles, resulting from the ingestion of soured and fermented foods, are consequently minimised. Soiled food should be removed from the troughs and never mixed with fresh food.

Correct feeding and watering, together with adequate housing and paddocking, are undoubtedly most important factors in the preservation of the health of the pig.

—*E. R. Hollamby.*

The Role of Legumes in Rejuvenating Old Soils.*

H. W. KERR.

IN his speech delivered when opening the Cairns Conference of the Queensland Society of Sugar Cane Technologists, the Minister for Agriculture and Stock (Hon. F. W. Bulcock) made special reference to the need for developing some means of restoring lands on the tropical Queensland coastal plain to a higher plane of fertility without direct recourse to the costly method of applying artificial manures. The Minister alluded to the growing of some form of legume, or possibly mixed pasture with legumes, which would serve to build up the humus and nitrogen content of the land, while also providing a pasture of superior quality to that which customarily occupies such lands.

This recommendation should not be turned lightly aside: indeed the policy outlined is fundamental to any project of soil rejuvenation. It is well known to agriculturists that legumes possess the interesting property of enriching the nitrogen content of the soil in which they are grown and ploughed under, by virtue of the co-operative effort which is accomplished between the host plant and the bacteria which live in the nodules to which they give rise, on the roots of their host. Legumes commonly employed for this specific purpose in the Queensland cane areas are Poona pea, black cowpea, and Mauritius bean; but there is a long series of leguminous species not so well-known to Queensland farmers but which find considerable favour in other States of the Commonwealth, and in countries overseas. As with other plant species, certain of these are better adapted than others for growth in any particular environment, and extensive experimentation is necessary to enable the most suitable legumes to be selected for a given set of conditions.

On the Queensland coastal lands which are devoted to cane production the particular conditions which are likely to be governing factors in this regard are (*a*) temperature, (*b*) soil acidity, and (*c*) general plant-food and soil moisture deficiencies. Vetches, for example, are generally restricted to the cooler regions, though they may prove successful as a winter crop in the tropics. Lucerne is generally regarded as a legume which likes a soil rich in lime, and with an absence of any marked degree of acidity; Poona pea, on the other hand, is not so sensitive to a moderate degree of soil acidity, though it does benefit of course from a dressing of lime applied to the soil before seeding. Poona pea will also withstand soil moisture deficiencies without undue distress, and yield satisfactory crops even where the general level of fertility of the soil is low.

In all probability there exist other leguminous species which could be tried to advantage under our conditions, and the Bureau has from time to time received supplies of seed of imported legumes for test purposes. A few years ago it was found for example that one of the "rattle-pod" family, known as *Crotolaria goreensis,* was a specially prolific cropper under the dry conditions of Southern Queensland; but its propagation was not encouraged in cane areas due to the danger of

* Reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations), July, 1937.

its becoming a noxious weed. It produced seed very freely and our experience suggested that it would be objectionable for short fallowing. However, where a long fallow legume is desired, it offers distinct possibilities, though careful study of its grazing value would be necessary, as certain of the *Crotolaria* are poisonous to stock. This particular legume is receiving considerable attention from the pineapple industry, where it is an important factor in arresting soil erosion on hillside slopes. It is planted in the interspace between the rows of pines and cut when in full growth.

There is another important feature of legume culture which has been appreciated only in relatively recent years. Though the standard species employed in any area may be grown without difficulty, a new legume may be virtually a failure when first planted, whereas subsequent crops on the same land may be quite successful. An interesting example of this phenomenon is the early attempt to grow lucerne (or "alfalfa" as it is called) in the United States of America. When lucerne was first introduced to certain parts of the country, it was a rank failure, for no apparent cause. Careful study showed that this was due to the absence of nodules on the roots of the plants, suggesting that the particular organisms responsible for their development were absent from the land. Inoculation of the land with soil from a field in which lucerne could be grown successfully was found to overcome the difficulty, while similar results could be accomplished by employing a laboratory culture prepared with organisms which had been expressed from nodules, and sprinkled over the seed before planting. So highly beneficial has this treatment proved that it has now become a standard farming practice in that country.

It is found, therefore, that the existence in the soil of the organism capable of effecting nodulation with, for example, lucerne, does not ensure success with all other species. On the contrary it has been shown that legumes may be classified in distinct groups, such that one strain of the root-nodule organism will serve most effectively all members of that group, but it is less effective or even quite ineffective with members of other groups. There are many known strains of organisms within the "cowpea group" alone, while at least a dozen cross-inoculation groups of organisms are recognised. It then becomes the problem of the soil bacteriologist to assure himself that the particular strain of the organism is present before the agriculturist attempts to test the value of new legumes in any field. In order to make sure he must culture the desired strain and inoculate the seed with this culture before seeding the field.

So important is this problem that the pathological branch of the Bureau has recently embarked on a full study of the question in connection with the importation of the new legume species which are being tested in the Queensland cane areas. At the present time a wide range of strains are being cultured in the laboratory, and the value of inoculation is also being tested with plantings of even the standard legume species when they are planted for the first time in canelands which have grown only other types of legume. The object of the work is threefold—firstly, to determine the possibility of improving the growth of legumes now grown for green manurial purposes; secondly, to acquire, if possible, more suitable species for this purpose; and thirdly, to explore the possibility of propagating legumes which have also a commercial value, as a means of providing alternative crops for excess sugar cane.

At the present time the growth of lupins in the Southern areas, of lucerne in the central and far northern coastal district, and trial areas of Berseem clover, wild white clover, lespedeza, and several soybean varieties are also planned. Seeds of these species, together with their special bacterial cultures, have been collected from other states of the Commonwealth and from overseas. They will therefore be subjected to careful and thorough trial, and canegrowers should be interested in the outcome of these efforts.

Of particular interest is, perhaps, the soybean, as it has become a crop of high potentialities commercially in the United States of America in recent times. The soybean is indeed one of the oldest cultivated crops. It is described in ancient Chinese literature of nearly 5,000 years ago. and in its value and variety of uses it is still the outstanding legume grown in China and Japan. It is only during the last twenty-five years that the culture of the crop has assumed any importance outside Asia; by 1924, over 5 million bushels of grain were harvested annually in the United States, while in 1935, that country produced a yield of almost 40 million bushels of beans.

The soybean is grown as a summer leguminous annual. The pods are from 1 to 2½ inches long, and contain from 2 to 4 seeds. Stems, leaves and seed pods are covered with short reddish-brown or grey hairs. The root nodules are large and abundant. The stems are branched, and grow from 2 to 3½ feet or more in height. It is grown over a wide range of conditions, from the semi-tropical to the temperate regions. With the exception of cowpea and lespedeza, it is more acid tolerant than any other legume crop grown in the American corn belt, but it will, of course, respond well to soil treatment. The beans need a well-prepared seed bed, in order to give them a good start ahead of the weeds. The seed is harvested by the use of the combine, which threshes out the beans and leaves the straw on the land, to be turned under to enrich the soil. The average yield for 1935 in the State of Illinois was 18 bushels per acre.

The beans have a high feed value, their average composition being as follows:—

	%
Moisture	10
Protein	36
Fat	17
Carbohydrates, etc.	27

They thus differ markedly from other legumes which are usually very much lower in both protein and fat.

The oil which is expressed from the beans may be utilized in the preparation of edible fats, or soaps, while its "drying" properties render it of value in the paint and varnish industry. The meal which remains after the oil is expressed is a valuable concentrate which finds extensive use as a stockfeed.

One of the most recent industrial developments is the utilization of meal as raw material in the preparation of "plastics," which now find wide application in the manufacture of a variety of articles in everyday use. A waterproof-glue for plywoods may also be made from soybean meal, and this product is now in great demand where high tensile strength is demanded. Lastly, the meal is a valuable fertilizer material, due to its high nitrogen content.

These brief notes should indicate the possibilities of this interesting crop. Certain varieties have been grown in trial plots in the neighbourhood of Brisbane in recent years, and some attempt has been made to grow them in the cane areas. So far, the results of the latter trials have been disappointing, and it is our purpose to seek the cause of this failure. Possibly the researches now being undertaken by our pathology staff will indicate the difficulty. Reports show that the crop can be grown in the Philippine Islands, and it would therefore not appear to be due to our high tropical temperatures and humidity. Perhaps it is a question of discovering the correct variety for our particular conditions.

PRUNING DECIDUOUS FRUIT TREES.

The pruning of deciduous fruit trees should be done as well as it is possible for the operator to do it.

To make a good job of pruning, good, clean, sharp tools are very necessary. Pruners will find it useful to provide themselves with a light box—fitted with a strap to make carrying easy—for holding secateurs, pruning saw, sharp pruning knife, oil-stone, oil-can, pot of coal tar, a brush and a bottle of disinfectant.

A good pair of secateurs is necessary, and they must be kept sharp and smooth. Every pruning cut causes a wound, but wounds of smaller diameter soon callus over provided the secateurs are sharp and clean. However, many pruners try to cut some of the larger limbs with their secateurs, and thus strain both the secateurs and their own wrists, while generally hacking the limb off and leaving rough edges which facilitate the entry of insect pests and fungous diseases. All large cuts should therefore be made with a saw, which, like the secateurs, should be both sharp and clean.

A sharp pruning knife is necessary for trimming the rough edges left by the saw, for, if they are not pared, callus formation is slow and the wound may not heal.

The need for an oil-stone and oil is obvious. A rub of the secateur blades on the oil-stone now and again keeps them keen and sharp, and makes the work much easier.

Pruners should always have with them a pot of coal tar, for tar is a disinfectant as well as a wood preservative, and, being pliable, makes a good surface covering. After pruning one tree and before going on the next, it is advantageous to paint all large cuts over with coal tar. The operation takes only a couple of minutes, and will help the tree considerably.

Both secateurs and saw often require disinfecting, for many diseases can be transferred from tree to tree by these implements. A strong solution of either formalin or corrosive sublimate rubbed over the blade with a rag will reduce any risk.

The foregoing suggestions are not trivial, as fruit trees on which a man depends for his living and which he expects to keep him for many years deserve the best treatment possible in regard to pruning as well as to cultivation and manuring.

H. St. J. Pratt.

An Attractive Pisé Dwelling.

A. E. GIBSON.*

THE merits of adobe or pisé structures, particularly where, for transport or other reasons, wood, brick, or concrete forms of construction are more or less impracticable, have been discussed previously in this Journal.†

Quite recently the construction of an attractive pisé dwelling and farm outbuildings at Woodridge by Mr. S. D. Galletly was under the notice of the Department of Agriculture and Stock.

Some two years ago Mr. Galletly conceived the idea of utilising pisé for the construction of a homestead and submitted samples of soil from his property to the Department for mechanical analysis. These tests proving satisfactory, he commenced building operations and gained valuable experience during their progress. To-day Mr. Galletly is the proud possessor of what is undoubtedly an attractive homestead, delightfully cool in summer and warm and cosy in the cold winter weather; and he has demonstrated successfully what can be done by an energetic man from materials close at hand.

The timber used in the building of the house was milled from hardwood timber grown on the property. Mr. Galletly has courteously supplied a ground plan of his house, together with a list of materials and details of the sizes of timber used; and these are submitted with the idea that they may be of guidance to those who are contemplating the erection of a house but to whom the idea of pisé construction has not previously occurred.

MATERIAL REQUIRED FOR COTTAGE AS DESIGNED.

WALLS, 10 FT. HIGH.

Main Building.

Doors and window frames.—22/10 ft.—8 in. x 2 in.

Top plate.—100 lineal ft.—4 in. x 2 in.

Ceiling joists.—11/16 ft.—3 in. x 2 in.

Rafters.—21/9 ft.—3 in. x 2 in.

Purlins.—200 lineal ft.—3 in. x $1\frac{1}{2}$ in.

Ridge pole.—34 lineal ft.—6 in. x 1 in.

Gable studs.—50 lineal ft.—3 in. x 2 in.

Ceiling.—800 super. feet.

Iron.—34 sheets—9 ft.

4 doors, 2 casements—6 ft. x 1 ft. 6 in.; 2—4 ft. x 3 ft.; 1—4 ft. x 4 ft.

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* Late Director of Agriculture.

† Q.A.J., Vol. xxxvi., July, 1931.

Plate 46.

An Example of Pisé Construction.—A farm homestead designed and built by Mr. Stewart Gallaty.

Side Gable Room.

Ground plate.—3/12 ft.—4 in. x 3 in.
Floor joists.—5/12 ft.—4 in. x 2 in.
Flooring.—175 super. ft. hardwood.
Ceiling joists.—5/12 ft.—3 in. x 2 in.
Rafters.—10/8 ft.—3 in. x 2 in.
Purlins.—80 lineal ft.—3 in. x $1\frac{1}{2}$ in.
Ridge pole.—1/20 ft.—6 in. x 1 in.
Weatherboards.—36 super. feet.
Ceiling.—8 sheets three-ply, 100 lineal ft. cover strips.
Iron.—30 sheets—9 ft.

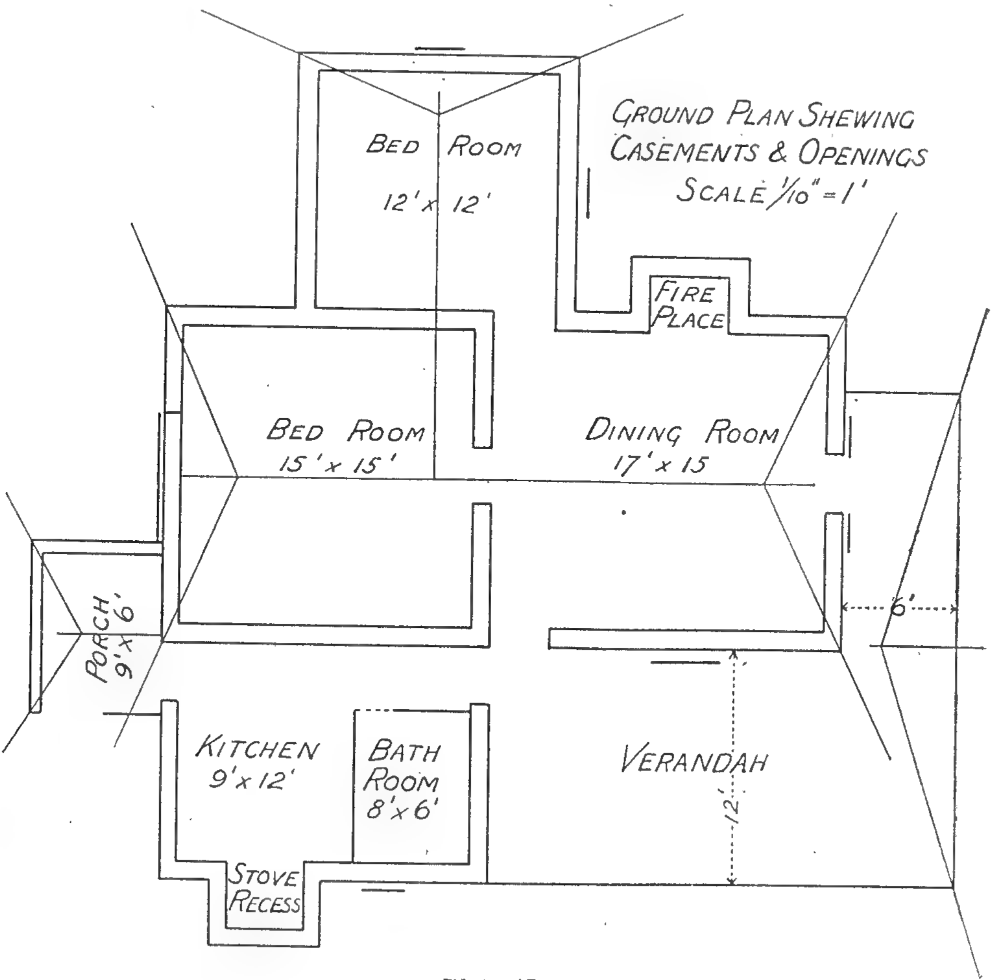


Plate 47.

Veranda, Kitchen, and Bathroom.

Ground plates.—3/24 ft., 3/6 ft.—4 in. x 3 in.
Floor joists—10/12 ft.—4 in. x 2 in.
Flooring.—400 super. ft. hardwood, shot edges.
Veranda posts.—6/8 ft.—4 in. x 4 in.
Veranda plate.—1/64 ft. lineal—6 in. x 2 in.
Rafters.—18/12 ft. 6 in.—3 in. x 2 in.

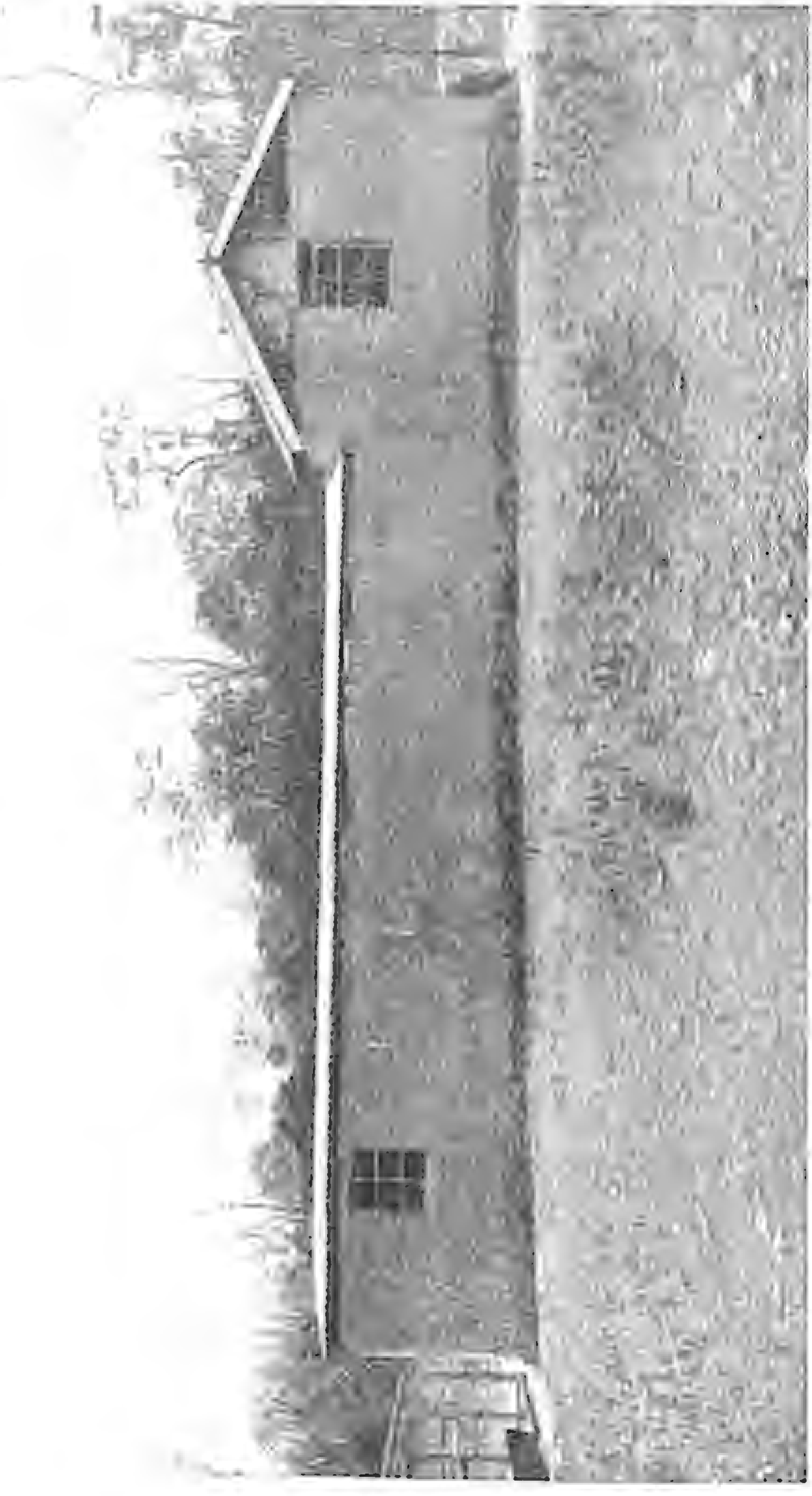


Plate 48.
Farm buildings of Pisé on Mr. Stewart Galletly's property near Woodridge.

Pole plate.—1/42 ft.—3 in. x 2 in.
Purlins.—250 lineal ft.—3 in. x 1½ in.
Gable studs.—25 lineal ft.—3 in. x 2 in.
Weatherboards.—75 super. ft.
Partition.—8 sheets three-ply.
3 doors, 2 windows.
Iron.—50 sheets—6 ft.
Flashing.—42 ft.

20 lengths of spouting.
10 lengths ridgecapping.
2 tons cement.
1 roll ruberoid.
Nails, paint, paper, &c., not shown.

CITRUS TREES AND THEIR FOOD REQUIREMENTS.

A citrus tree does not grow at a uniform rate, but makes three or more growths of shoots and leaves each year. The times when these growths occur, and the degree of their development, may vary with local conditions, the availability of plant foods and methods of tillage and irrigation.

In the spring, shortly before blossoming, the heaviest growth occurs, and from this stage, particularly until the approach of the wet season, the soil should be maintained in good cultural condition to enable the trees to obtain the essential plant foods by means of a healthy, vigorous root system. There is a smaller and irregular growth of twigs and leaves about midsummer, and a third growth in the autumn.

In the trunk and main branches dissolved mineral matter taken from the soil by the roots passes upwards to the leaves, and elaborated plant foods pass downwards from the leaves to the roots. Citrus trees in healthy condition do not shed their leaves before the new ones have become at least partially developed; therefore, the heaviest leaf fall usually takes place after the spring growth.

Careful tillage and drainage, although absolutely necessary for successful fruit growing, are not, however, sufficient to maintain the fertility of the land from year to year without the aid of organic manures or fertilizers. Growers from practical experience have learned the truth of this statement. Owing to the difficulty of procuring sufficient quantities of organic manure, mineral fertilizers are applied which supply nitrogen, phosphoric acid, and potash to the soil, each constituent being necessary for the production of good fruit and the maintenance of healthy trees.

Certain points relative to the effects that these constituents are likely to have on the development of the trees, and on the production of the orchard, are worth considering, in order that growers may be able to decide as to their own particular requirements.

The effects of a generous supply of nitrogen are much more apparent than those of either phosphoric acid or potash. Nitrogen stimulates vegetative growth and large applications of it will increase the amount of rag and the thickness of the rind of the fruit. Insufficient nitrogen, however, is indicated by yellowish-coloured leaves, and the trees generally have a stunted appearance.

Unless adequate phosphoric acid is available the fruit does not develop normally. Phosphatic manures promote root development, and heavy applications hasten the maturity of the fruit.

Large quantities of potash will cause the rind of the fruit to be much thinner, and have a marked influence in improving the keeping and carrying qualities of the fruit. Potash also increases the vigour of the tree, and intensifies its resistance to adverse conditions.

These facts show that these three plant foods must be judiciously balanced to meet the requirements of the trees.

—*H. Collard.*

Sunspots and Climate.

H. I. JENSEN, D.Sc.*

IN a scientific paper published in 1904, the writer drew attention to the correlation between sunspot minima and protracted droughts in Australia. Thus 1811, 1822, 1833, 1844-46, 1855, 1864-69, 1877, 1888-89, 1900 to 1902, 1912, 1923-24, and 1934-36 have been periods of drought, and the most disastrous of these were in the "Great minima" of 1833, 1864-67, 1900-1902, 1934-36.

It is noticeable that all the droughts of a protracted and widespread nature came in periods of sunspot minimum, approximately at an eleven years interval, and the worst in the periods of Brückner minima, at an approximately thirty-five years interval.

The idea of such a relationship existing between climate and sunspots was by no means new. Dr. Brückner and Dr. Julius Hann, notable German-Austrian meteorologists, had many years earlier noticed the same facts in regard to European climate.

Sir Norman Lockyer, the great British astronomer, was a protagonist of the close inter-relationship of sunspot and weather cycles, and Alexander McDowall, a Scottish scientist, had demonstrated that the time of the flowering of plants was affected by the sunspot cycle.

Jevons, the English economist, had many years earlier shown that the world's prices of wheat fluctuated with the sunspot cycle, and that Indian famines coincided with years of sunspot minima.

During the past forty years great droughts have commenced and ended earlier in the Northern hemisphere than in the Southern. The drought of 1900-1902 affected Argentine, Egypt, India, Europe, and Siberia, as well as Australia, but commenced and ended earlier in Europe than in Australia. The drought of 1922-23 in Russia and Siberia affected Australia in 1923-24, and the last great drought has been playing havoc in Europe and America for several years.

In spite of the fact that this periodicity or cyclical recurrence of great droughts is so well known, American and international wheat speculators do not ignore well-known and well-established facts about the connection between sunspots and wheat prices.

Our producers' organisations, on the other hand, apparently disregard these facts. Thus it is reported that almost the whole 47,000,000 bushels of the New South Wales 1935 wheat-crop were exported early in 1936 and a large portion of the 1936 crop was sold in advance at a loss of 1s. 6d. to 2s. per bushel on the world price for 1936. Thus the farmers of New South Wales lost at least £3,000,000 by not having an organisation capable of anticipating price fluctuations, and wheat speculators benefited to that extent. Millions of head of cattle and sheep have been lost through drought which could and should have been saved.

The present writer wrote several articles on this subject in 1922 and 1923. In one of these ("Daily Mail," Brisbane, 6th January, 1923) he remarked: "There seems to be little hope of science ever being able

* Formerly Government Geologist, Northern Territory, and of the Department of Mines, Queensland.

to achieve exact seasonal forecasts for small districts. The best that astronomy can yield is a general continental forecast, giving indication of the class of season to expect. This, however, should be of great aid to agriculturists and pastoralists.

"Owing to the mobility of the atmosphere, small causes often produced by the action of man, such as a bushfire, the clearing of virgin scrub, or similar occurrences, frequently cause an abnormal season for the environment." The position is still the same although, during the last few years, South African meteorologists have found that moderately correct forecasts for individual districts can be made, other things being equal, by studying past rainfall records in relation to sunspot minima and maxima.

There is a tendency for the same type of season to recur in the same district at the same approximate period from each maximum and minimum. If it could be proved that the same tendency held good for Australia it would be very helpful.

In the same article reference was made to experiments in rain-making, and the fact was emphasised that the necessary condition for rain-making artificially is that moisture-laden clouds must be present, and that up to the time of writing no rain-making experiments had been successful. In another article in the "Daily Mail" (December, 1926) the writer suggested the use of aeroplanes to shoot dust into the clouds for the purpose of forming condensation nuclei.

During the last couple of years this method has been successfully tried in Europe; but in all rain-making the first essential is favourable conditions, and they do not often exist in sunspot minima.

In another article in the "Western Star" (23rd March, 1928) the writer said: "We may expect good years from 1928 to 1932 and then a gradual desiccation culminating in a record drought from 1934 to 1937."

In various statements to the North Queensland press in 1934 the writer again gave a warning that the increasing frequency of earthquakes and volcanic eruptions in other parts of the world were a portent that a fresh drought was commencing, and he said that a serious drought was to be expected in 1935 and 1936.

It was pointed out in these articles that there was yet time to make provision for stock, and to perfect organisations for the marketing of produce both to protect the Australian farmers against exploitation at the hands of speculators, and the Australian pastoralists against excessive prices for feed for starving stock.

Unfortunately nature's warnings have been ignored, and few, if any, of Australia's stockowners have made any provision against drought in the past. It now avails little to discuss what might have been done; but it is to be hoped that professors of agriculture, scientists guiding the pastoral industry, and the great farmers' and pastoralists' organisations will set a little time aside between now and the next anticipated droughts (1946-47 and 1957-58) to go into ways and means of reducing drought losses to a minimum. It is also to be hoped that national policy will include the provision of substantial sums for the making of dams and irrigation channels, silo construction for the conservation of native fodder grasses, and similar undertakings.

Judging Pork and Bacon Carcases.

IN an article appearing in the "Pig Breeders' Annual" for 1936-37 details are disclosed of a standard method of valuing porker and baconer carcases supplied to the British market which, it is believed, will be welcomed heartily by men prominent in the pig industry in Australia. This method has been arrived at through the collaboration of Mr. H. R. Davidson, M.A. (Cantab.), Dip. Agric., late School of Agriculture, Cambridge, and Rowett Research Institute, Aberdeen; John Hammond, M.A., D.Sc., F.R.S., School of Agriculture, Cambridge University; and Jos. B. Swain and Nevill L. Wright, F.I.C., D.I.C., Scientific Liaison Officer, New Zealand Government.

In reviewing the article, Mr. L. A. Downey, H.D.A., Instructor in Pig Raising, says all will agree that the consumer is the judge who counts really in deciding the quality of pork and pork products, and it is necessary therefore to base any system of pig-judging on a knowledge of the consumer's requirements.

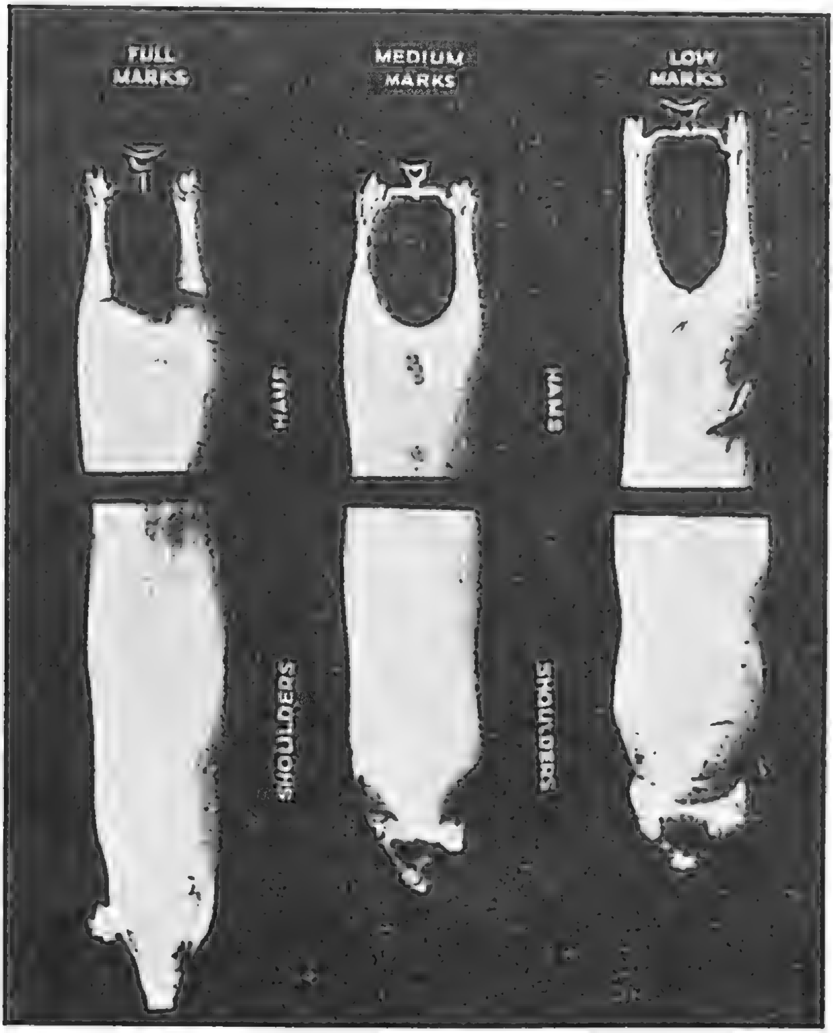
When judging breeding pigs, the good judge keeps well in mind trade and consumer requirements, and balances these features with constitution and breeding ability, characteristics which are of such importance to farmers.

In judging porkers and baconers alive, the judge endeavours to anticipate how the pigs will appear in carcase form and how closely their carcases will conform to his idea of trade requirements. In such a task he must do some guess-work. The judging of carcases is far more reliable than live pig judging, for one can see actually what lies under the coat when the pig is dressed and opened up. Even carcase-judging may not be altogether reliable, because, if the carcases are judged on appearance only, and compared with the ideal in the judge's mind, that factor of individual opinion, which is very variable, will play always a big part in the making of decisions.

British and Australian Standards.

The authors, says Mr. Downey, offer their method for the guidance of those supplying frozen porkers and baconers to the British market, for use in judging competitions, and for individual farmers to check up on the carcase quality of their pigs. Although prepared for pigs supplied to the British market, the standard for judging is found to agree very closely with the requirements of the Australian domestic trade.

JUDGING BY EYE APPRAISAL.
STANDARDS FOR AWARD OF MARKS.



[*Produced for New Zealand Evaluation Committee by Jos. B. Swain.*

Plate 49.

Careful consideration has been given by the authors to consumers' requirements in arriving at the proportion of the total marks to be allotted for each feature of the carcase, and in determining the most desirable measurements for the various parts of carcases of given weight classifications. Such a sense of proportion is shown by the valuation of carcases that, when one has valued a carcase according to this method, he has a feeling of complete satisfaction that the results must be correct. Such a balance of values is very difficult to obtain by

a mere visual inspection of the carcase as a whole, as has been practised previously in carcase competitions.

With the object of providing a standard system which can be used by almost anyone (not necessarily an expert) and which is not influenced by the personal opinion of the judge, the authors have, in their own words, "whenever possible, tried to obtain a *measurement* to express the point, rather than to rely on visual judgment, into which the personal element enters. As regards three points, however (hams, shoulders, and streaks), we have not yet been able to arrive at a satisfactory measurement. For the streak, several methods have been tried and discarded as imperfect. Further work on these points is required before judgment by measurement is applied. Therefore, for the judgment of hams, shoulders, and streaks by the visual method, we have constructed photographic standards covering the allotted range of marks, so that the personal element can be reduced to a minimum."

The Scale of Points.

The scale of points is divided under the headings of marketing points and breeders' points, the latter being subdivided into points by inspection and points by measurement.

The standard of marking suggested is very severe and only good carcases will obtain more than 50 per cent. of the total. There is room, however, for a really excellent carcase to get close to 100 per cent.

	Marks. Porkers.	Marks. Baconers.
(1) Marketing points—		
Colour—clean, fresh, white	5	5
Skin—smooth and fine	5	
Dressing—freedom from bruises and hair	5	5
	15	10
(2) Breeders' points—		
(*a*) By inspection:		
Hams—well-filled and fine-boned	8	8
Shoulders—light	7	7
Streak—thick, full of lean meat	12	12
(*b*) By measurement:		
"Eye muscle" of loin, thick	28	28
Backfat thickness, correct proportion	20	20
Body length in proportion to weight	20	20
Leg length—short	5	5
	100	100
(3) Suitability of carcase weight		15
Total Marks	115	125

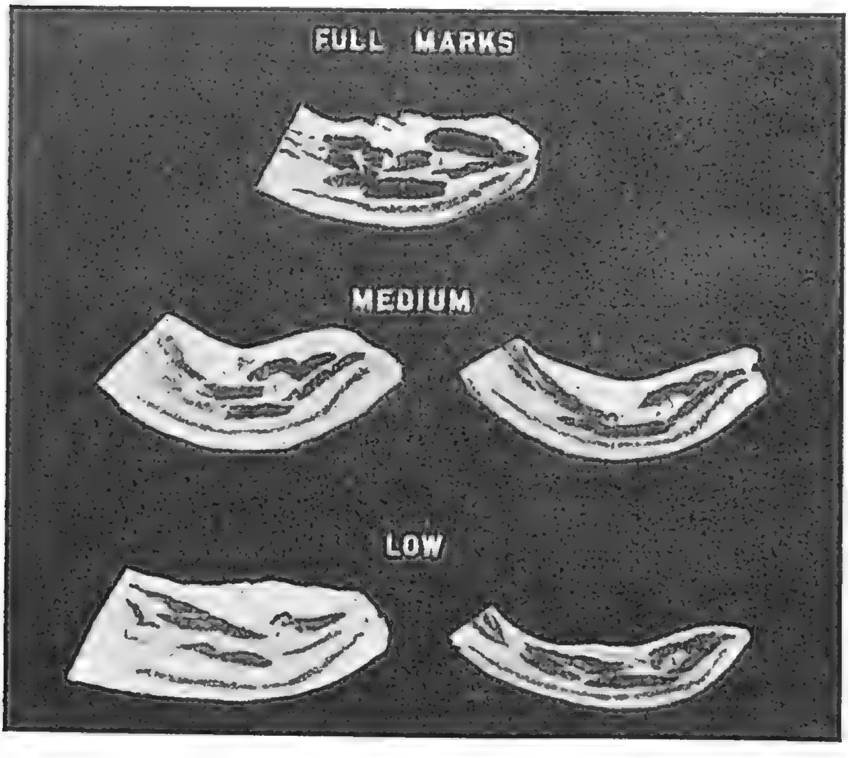
With regard to porkers, the article states: "The weights of carcases most in demand for the London trade are from 60 to 80 lb., although during the summer months, and in some other markets, there is some demand for heavier carcases for cutting purposes. The latter conveniently fall into two main groups—80 to 100 lb. and 100 to 120 lb. Since the main trend of future trade, in analogy with "Canterbury

lamb,'' will probably be with the 60 to 80 lb. group, it is on this group that we have concentrated most. Scales, however, have been prepared for the other groups as well.''

With baconers, the standard adopted was a Class I. carcase for the Wiltshire bacon trade under the British grading specifications, and as a guide to overseas producers the authors suggest a carcase weight range of 135 to 154 lb. as being most desirable, and where a guide is wanted the 15 points are included in the scale of points.

STANDARDS FOR AWARD OF MARKS.
BY EYE APPRAISAL.

STREAK (BACONER).



[*Produced for New Zealand Evaluation Committee by Jos. B. Swain.*

Plate 50.

Method of Procedure.

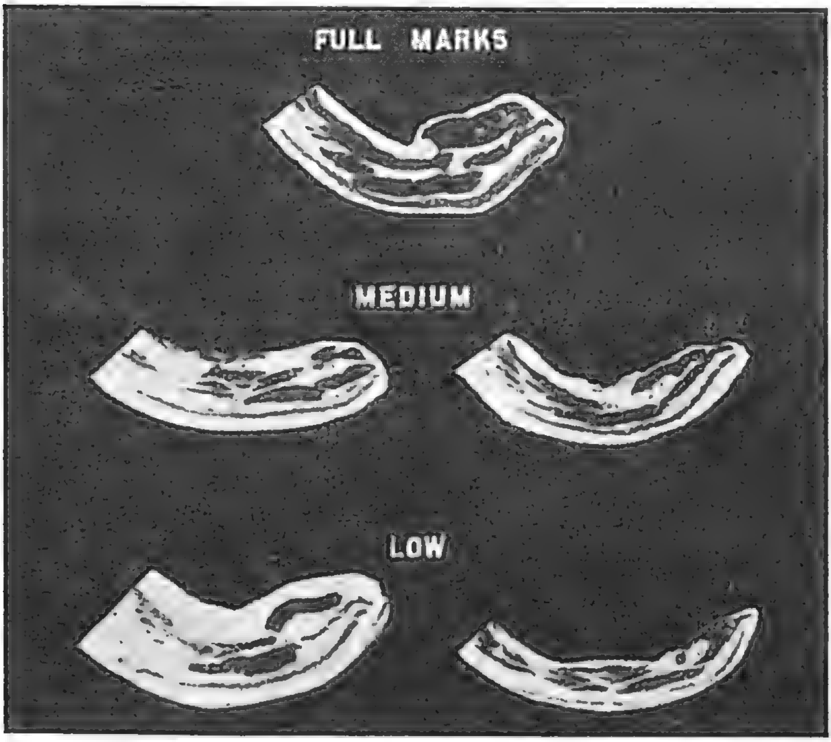
Having ascertained the weights of carcases, the judge views them from behind and values each carcase on the marketing points as shown in the scale of points, and on the hams and shoulders, using as a standard the photographs as shown in plate 47 the suggested marking being the possible 8 points for the best hams, 4 points for the medium hams, and 1 point for the worst hams in the illustration, and, of course, varying points in between these according to the relative value of the hams. The shoulders are valued in comparison with the photographic standard, in which the best shoulders are valued at 7 points, the worst at 1 point, and the intermediate shoulders at 4 points: the judge then uses his discretion regarding shoulders falling between those illustrated.

The carcases are sawn down the centre line into two sides, and the length of body and length of leg are taken from the points shown in plate 48, using a tape measure graduated in millimetres. As the length of body and shortness of leg are valued in proportion to the

carcase weight, tables have been prepared indicating the most desirable measurements for pigs of any particular weight range, and by reference to these tables, according to the weight of the carcase and its measurements, the judge can read off the number of points gained by each carcase for these features.

STANDARDS FOR AWARD OF MARKS.
BY EYE APPRAISAL.

STREAK (PORKER).



[*Produced for New Zealand Evaluation Committee by Jos. B. Swain.*

Plate 51.

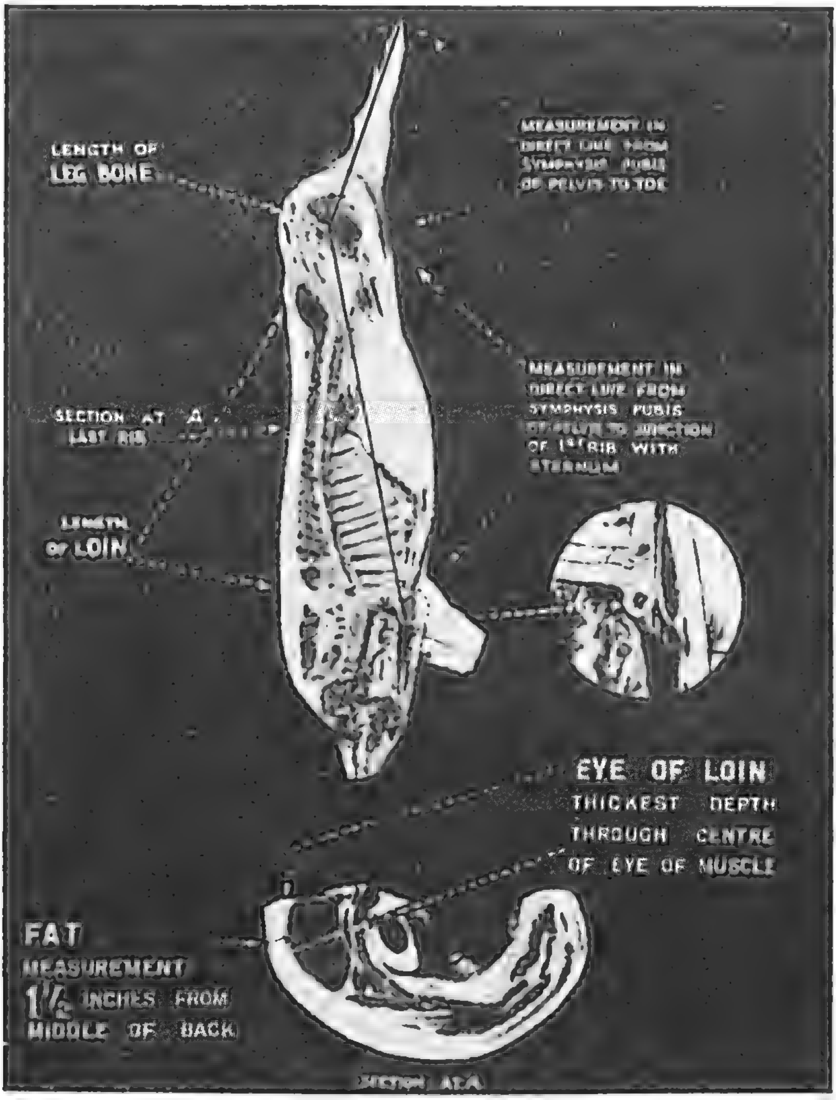
One side of the carcase is then cut through level with the last rib, and from the cut surface of the hind part of the side, further valuations are made. The streak is compared with the photographic standard (see plates 49 and 50) and marked according to the standard—namely, 12 points for best, 1 point for the worst, and 6 points for the medium streaks, as illustrated. The streak should be thick and fleshy, and in porkers there should be a greater proportion of lean to fat than is required in baconers.

The eye muscle and back fat are then measured by callipers at the positions shown in plate 48, excepting that on porkers the backfat measurement is taken 1 inch from the middle line, whereas on baconers it is taken 1½ inches from the middle line. These measurements are then referred to tables provided, to give their respective value in accordance with the weight of the carcase.

The award sheet on a carcase gives the breeder a lead towards determining the cause of any defect in his pig carcases. For example, a badly shaped ham or shoulder is obviously a fault in the conformation

of breeding stock, and a thin streak may be due to inherited faulty conformation or to giving the pigs too much bulky food or excessive liquid. An under-developed eye muscle is probably inherited to some extent, but it may also be due to faulty feeding, such as a deficiency of protein when the pig is in its early growth stage, about weaning time.

JUDGING BY AWARD OF MARKS FROM MEASUREMENT.



[*Produced for New Zealand Evaluation Committee by Jos. B. Swain.*

Plate 52.

Too little or too much backfat may be due to faulty feeding, but mostly it indicates that the pig had either not reached, or had passed, that stage of maturity at which it would have given a good carcase. A porker type pig slaughtered at bacon weight can usually be expected to give an over-fat carcase.

Length of body is certainly inherited, but it is possibly influenced by feeding and management to a limited extent. Pigs vary in the number of ribs they possess, and this materially affects their length

of body. When a carcase is too long in the leg it is due either to inheritance or to having been slaughtered before it was sufficiently matured.

It will be gathered that the system of judging is most exacting, but it can be of immense value to the careful pig breeder who desires definite information on which to base his work.

Already some preliminary judging by these methods has been carried out in Queensland, and the carcases of the export bacon pigs at the 1937 Royal National Show held in Brisbane will be judged on the new scheme of marking.

PREPARATION OF LAND FOR MAIZE.

To get the best results maize requires a good soil, in which a plentiful supply of plant food is available, a condition which can only be brought about by an early and thorough preparation of the land before planting, attention to the cultivation of the crop itself, and to the eradication of young weeds during its early growth.

The land should be ploughed to a depth of at least nine inches during the winter and allowed to lie in the rough until the early spring. The action of the frost and the rain will improve the texture of the soil and will leave it in a mellow condition. In the early spring the land should receive a second ploughing, —if possible, a cross ploughing. This should not be so deep as the first ploughing, and should be immediately followed by a harrowing and cross harrowing to work the surface soil into a fine tilth.

If a crop of weeds is turned under during the second ploughing, planting should not be carried out for at least a few weeks to allow decomposition to take place. On land which is not too heavy and moist, rolling is desirable, as it consolidates the soil and helps to make a good firm seedbed. Rolling should always be followed by a light harrowing.

Preparation of Seedbeds.—The preparation of the seedbed is one of the most important points in the production of maize and no amount of after cultivation will undo the damage caused by planting in a badly prepared piece of land.

One has only to see the difference, not only in the growth but in the colour of the foliage also, between a crop grown on thoroughly prepared and another on hastily prepared land, to realise how great the effect is.

Give the young crop a chance to become well established in a well-prepared seedbed—in which the young plants will not have to battle with a host of weeds—and the increased return will more than compensate for the extra time and labour spent.

Time to plant.—The best time to plant will naturally vary in different districts. In districts which have a long growing season and a comparatively regular rainfall, planting can be carried out whenever weather conditions are suitable, from August to late December.

Two very important points are—firstly, to choose a variety which is suitable for the district; and secondly, to try and have the crops tasselling during periods in which rain can usually be expected. Maize must have moist conditions during tasselling, and if hot, dry winds occur during this period, the pollen is shed too early and fertilization cannot take place.

Seed should be sown in drills spaced 3 ft. 6 in. to 4 ft. apart. The wider spacing is essential for the tall-growing, late-maturing varieties. As a general rule, single spacing in the rows gives the best results, the grains being dropped singly, with a distance of approximately 12 in. between the grains for the quick-maturing varieties, and from 15 to 18 in. for the late-maturing varieties.

From 9 lb. to 12 lb. of seed is sufficient to plant an acre when sown in this manner.

The seed drill is the most satisfactory implement for sowing maize, as it ensures a good even spacing, and no loss of moisture occurs during planting, as is often the case where furrows have to be opened up for hand planting.

C. J. McKeon.

Weighing Pigs on the Farm.

W. H. BECHTEL, Instructor in Agriculture, and A. L. CLAY, B.V.Sc.,
Government Veterinary Surgeon.

ALL farmers engaged in the production of pigs, either as a main occupation or as a sideline, have doubtless felt the need for an easy, reliable, and economical method of weighing pigs.

It is advisable, if not essential, that pigs should be weighed at intervals during the growing stages, as it is by this means only that a correct knowledge of the relation between feeding and gains in live weight can be obtained. All pigs should be weighed immediately before being marketed, as in this way misunderstandings between the grower and the factory will be obviated.

Plate 53.
Weighing Basket made with Lawyer Vine.

On the Atherton Tableland we have found that a combination consisting of a spring balance and basket (see illustrations) fulfils the required conditions as near to perfection as reasonably can be expected. The contrivance has the added advantage of being easily portable.

The basket is made of lawyer vine (which is obtainable locally), but imported basket canes would probably serve as well should lawyer vine be unprocurable. Briefly, it may be described as being of a woven open-mesh type, shaped like a blunt-nosed bullet, and standing 48 inches in height, with a diameter of 24 inches at the top and tapering off to 10 inches at the bottom. The vertical ribs are in one piece, being continuous around the bottom of the basket. They are $\frac{3}{4}$ inch to 1 inch in diameter, nine in number, and spaced 4 inches apart at the top, coming together to a folded-over interlaced cap at the

Plate 54.

Spring Balance and Basket in use.

bottom, and finally finished off into a woven top. The cross stays are of $\frac{3}{8}$ inch diameter, being three-ply used in a twisted woven fashion in and out of the vertical ribs, commencing at the top with an 8-inch wide close section, then passing around the basket in a spiral fashion, beginning with a 4-inch spacing and gradually reducing to a 2-inch spacing at the bottom. These cross stays are held in position by looping a light cane from top to bottom along each rib.

To strengthen the hard-wearing parts, especially the bottom, small canes are interwoven to form a close-filled cap. Upon completion the weight of the basket ranges from 23-25 lb. when green, this being reduced to 16-18 lb. when dried out.

It is not anticipated that the average farmer will be able to make these baskets, but with the description given, together with the illustration (plate 51), any basket-maker of repute should have no difficulty in making them.

The spring balance used has been of the "Salter" type and capable of weighing up to 300 lb. The only other equipment necessary is an upright beam made of a 6-ft. length of 4 x 2 inch timber, a lever made of an 8-ft. length of 3 x 2 inch timber, one bolt and nut, and one open eye-bolt and nut. The lever is bolted into the free end of the upright so as to make a hinged joint. In the illustration (plate 52) the basket is shown outside the pig pen for clearer definition; but in actual practice the lever is worked from outside and the basket with the pig in it is raised into the air from inside the pen.

No difficulty has been found in getting pigs into the basket, and in point of fact, after having been weighed several times, pigs have been found to walk into the baskets of their own accord. Pigs from 25 lb to 200 lb. have been weighed with ease.

SWEET POTATOES AND ARROWROOT FOR PIGS.

With the approach of spring, farmers are considering their cropping programmes, and so the time is opportune for considering the value of such root crops as sweet potatoes and arrowroot as pig foods. These two crops are well known to most coastal pig farmers and can be grown in most places where there is a sufficient rainfall and a long summer season.

Under similar conditions the yield of pig feed per acre from arrowroot and sweet potatoes is several times that from maize grain. This fact alone makes these crops worthy of consideration, but they also have the advantage of being less susceptible to periods of dry weather and are usually freer from pests. In the case of sweet potatoes, some growers claim that they are worth growing for the vines alone. The vines of the sweet potatoes and the stalks and leaves of the arrowroot provide a large quantity of succulent green food.

If it is necessary to harvest and feed these crops by hand, the labour involved is considerable; but both crops can be fed off by pigs, and where the paddocks are made pig-proof, and some temporary fencing is used to partition off a small portion of the crop for the pigs to harvest, excellent results are obtained. If pigs are allowed to run over the whole crop a good deal of waste results. They should, therefore, be confined on an area which they can clean up in about one week.

Arrowroot is frequently boiled before being fed to pigs; but, although the boiling does increase its nutritive value somewhat, it is doubtful whether the increase warrants the great amount of labour required to dig, cart, and boil the bulbs, especially when it has been demonstrated that pigs do remarkably well by harvesting the crop for themselves.

Sweet potatoes and arrowroot are not complete foods in themselves, and must be fed in combination with foods rich in protein, such as separated milk or meat-meal. The more extensive use of these two crops, in conjunction with the separated milk at present available, would enable coastal dairy farmers to increase their output of pigs greatly, and this would be very desirable in the interests of the pig industry at the present time.

L. A. Downey.

Queensland Pigs Successful at Sydney Show.

QUEENSLAND pig breeders have for a long time considered their stock equal to the best in the Commonwealth, and the competition at Royal Shows in this and other States certainly provides evidence in support of this belief.

Plate 55.

Tamworth sow, Wattledale Trilby, bred by J. Barkle and Sons, Wattledale Stud, Kingaroy, and owned and exhibited by Wide Bay Stud Piggery, Gympie. Wattledale Trilby is by Wattledale Top and from Taitlands Queen.

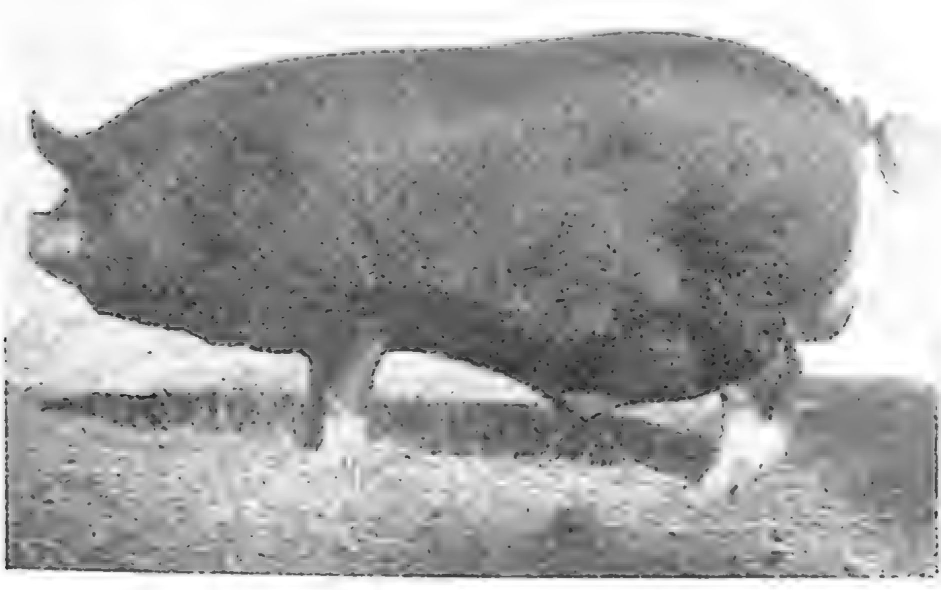


Plate 56.

Berkshire boar, Woodbine Lentonious 5th, bred by F. Bach, Woodbine Stud, Oakey, and owned and exhibited by Wide Bay Stud Piggery, Gympie. Woodbine Lentonious 5th is by Roselock Ronnie and from Lenton Patience (imp).

At the 1937 Sydney Royal Show a team of six pigs from a Queensland stud was particularly successful, winning two breed championships, four first prizes, one second prize, and one third prize.

The two champions of this team are shown on the previous page, the photographs having been taken since their return from Sydney.

Plate 57.

Farmers listening to an address on pig accommodation on the occasion of a field day arranged by the Gympie District Pig Breeders' Association on the property of Mr. W. Dawson, Wonga, via Woolooga.

The movable sheds and runs as seen in the illustration were greatly admired by visitors for their practicability and low cost.

SICK PIGS ARE UNPROFITABLE.

The healthier the pigs the more rapid and more economical are the gains in live weight. Keep your pigs healthy by:—

Always having the yards and runs free of mud holes.

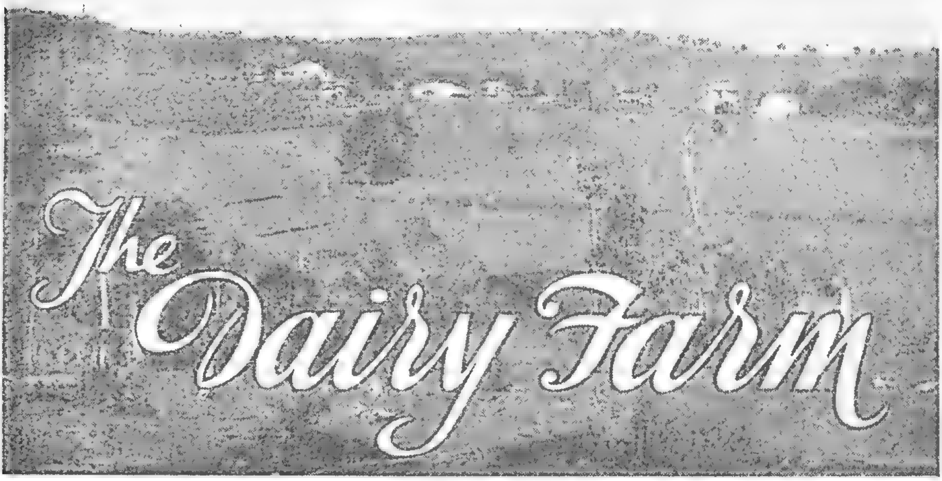
Providing clean water.

Frequently and regularly cleaning and disinfecting.

Keeping quarters dry, clean, and free from draughts.

Feeding proper rations.

Grazing pigs on clean pasture.



Factors in the Contamination of Milk and Cream.

E. B. RICE, Dairy Research Laboratory.

Of all the factors responsible for depreciating the quality of milk and cream, the activities of bacteria, the most lowly forms of life, easily assume major importance. Milk from the udder of a healthy cow contains very few bacteria, but it is not long before many are added from various sources. The chief points from which these may enter are:—

1. The cow.
2. The milker.
3. Water.
4. Bails and surroundings.
5. Air and feed.
6. Utensils.

The Cow.

Milk from the udder of a healthy, well-fed cow contains very few bacteria, these being mainly types which have entered through the teat canal, and, fortunately, they are very slow in bringing about changes in milk. However, the milk from a diseased beast may have an abnormally high bacterial content which would infect the milk from other animals mixed with it. Furthermore, such milk might spread the disease amongst persons or animals consuming it.

Immediately after it is drawn from the udder, the milk becomes more or less contaminated, the bacteria falling from the coat of the animal with dust particles and loose hairs. It is therefore necessary that animals should be kept reasonably clean, and that the udders and near portions of the body should be wiped with a damp cloth, moistened with weak Condy's fluid. The wiping of the udders is also beneficial

for the reason that bacteria cannot fall from a wet surface. The number of germs ordinarily dropping from the coat of the animal into the milking pail is considerable. An investigation of the matter has shown that in a dairy where the animals were divided into two groups, the group whose udders were not wiped added an average of 7,000 bacteria per cubic centimetre (about ten drops) to the milk, whereas the group whose udders were wiped contributed an average of only 700 bacteria per c.c. However, attention should be called to the necessity for frequent changing of the cloths, as the benefits will be lost if one rag is used for, say, twenty cows. A further essential is that the cloths should be boiled after each period of use and hung to dry in a dust-free place.

The Milker.

Many dairymen fail to recognise the extent to which the milker influences the quality of the product. Material from the hands, clothing, and mouth of the person gets into the milk, the extent of the contamination from this source depending upon the personal habits of the individual. Disease germs, too, may enter the milk from a person suffering from disease, possibly causing a widespread epidemic in a district. Clean hands and clean clothing are important considerations in the hygienic production of milk, The hands should be washed immediately before milking each cow; and clean overalls, kept only for milking, would be a decided advantage. Facilities for washing the hands, such as a washbowl, water, soap, and towels, should be provided in every dairy.

Closely related to the milker is the question of sanitary methods. Figures quoted by an American authority reveal the fact that, on ten farms where the milkers were inexperienced in cleanly methods, the bacterial counts averaged 2,500,000 per c.c. When ten men experienced in sanitary methods milked on the same farms the counts were reduced to an average of 9,000 bacteria per c.c. In another investigation carried out on ninety farms in two months of one year, before sanitary methods were introduced, the bacterial counts averaged 393,000 per c.c. On the same farms in the same months a year later, after sanitary methods were adopted, the counts on the milk averaged 55,000 per c.c.

The methods by which these results were achieved were: —

(1.) Washing the udders free from dirt and milking with clean, dry hands.

(2.) Sterilisation of pails, cans, strainers, &c., with boiling water.

(3.) Cooling by submerging the cans in tanks of spring or ice water.

Water.

Clean, pure drinking water is required for dairy stock. Water from stagnant pools, dams, &c., is a menace to cream quality, for the animals wading into such places pick up microbes on their coats which later, during milking, fall from the body into the pail. The microbes rapidly multiply in the favourable food medium. In this manner such common faults as ropiness and gassiness often originate; and the microbes, once established in the bails and utensils, become difficult to eradicate. Careful attention should be devoted to the wiping of the udders of animals which have access to polluted water, and, if possible, it should be fenced off.

Buildings and Bails.

Milk of good quality can be produced where bails, buildings, and yards are not elaborate, but where precautions are taken against factors known to militate against cleanly production. In fact, the writer has in mind a dairy in Brisbane which produces certified milk, such milk having to conform to a maximum bacterial content of 30,000 per c.c., which is regarded in all countries as a fairly rigid standard. It is safe to assert that the buildings on this farm would be no better than those on 50 per cent. of the farms in any of the leading dairying districts of the State; but sound methods are the secret of this man's success.

Liberal applications of lime to the floors and the whitewashing of the walls of the bails at regular intervals check bacteria. The daily carting away of all manure which has accumulated in the yard and on the floor of the bails is a matter of routine in any well-kept dairy. If this is not done, the manure becomes pulverised into dust, which is blown about the buildings and ultimately gets into the milk. Among the microbes found in manure are types responsible for gassy fermentation, which is most objectionable. The handling of dirty leg-ropes and stools without washing the hands afterwards is a practice which calls for condemnation. Good ventilation and plenty of sunlight help to achieve choice quality, and so the bails should face the north to gain the maximum benefit from the natural light.

Air and Feed.

The air in the bails, so long as the yards and floors are kept in proper order, has not such a serious contaminating influence as might be expected. The microbes which are transported by dust particles have to be of resistant species or they are destroyed by the direct sunlight, absence of moisture, and lack of food. On the other hand, with a dirty and dusty yard, the air is literally teeming with millions of microbes, many being very injurious to milk. The feeding of hay and silage during milking should be discontinued, because yeasty cream and other defects are brought about by microbes in the dust from such foods.

Condition of Utensils.

Of the original bacterial contamination of milk and cream, 80 per cent. is traceable to a failure to keep the utensils thoroughly clean. Boiling water should be used after all traces of milk solids have been removed. This is done by first rinsing the utensils with cold or luke-warm water to dissolve the albumin, which would coagulate and form a thin film on the surface of the utensils if hot water were brought directly into contact with it, but which is soluble in cold or warm water. The vessels are next scrubbed with hot water in which washing soda has been dissolved. A scrubbing brush should be used for this purpose, as cloths would be ineffective. The utensils should then be submerged in the boiling water for at least one minute and then placed on the draining rack so that the water can run off. Their heat causes them to dry rapidly. Since all bacterial food is removed by washing, all bacteria killed by boiling water, and all moisture drained away or evaporated by the heat, any few bacteria which may re-enter from the air of a hygienic dairy will not cause undesirable changes in milk subsequently placed in the utensils.

CARE OF MILK AND CREAM.

After the milk or cream is produced care must be taken to avoid any further contamination and to prevent an increase in the numbers of the germs which have entered, otherwise all efforts previously expended in producing a choice quality article may be forfeited.

Some of the chief factors in the development of after-production faults are:—

1. The state of the dairy.
2. Improper cooling.
3. Care during transit to factory.
4. Faulty containers.

The Dairy.

Many old-style dairy houses, through lack of proper ventilation, are veritable hotboxes. At the high temperatures in such dairies on hot summer days the bacteria will multiply with enormous rapidity and nullify all efforts made to keep them in check during the previous handling. The recent amendments to the Dairy Produce Act have remedied this matter by providing for a new type of dairy house which ensures more adequate ventilation. In this new dairy with gauze or wire-netting at the top and bottom it will be necessary to cover the cream to prevent contamination in dusty weather. Where sufficient water is available the inclusion of a concrete trough about 8 inches deep by 2 feet 6 inches wide in the southern end of the dairy is an aid to the cooling of cream, but frequent replacement of water is required in order to ensure satisfactory conditions.

Cooling.

The difficulty in the way of cooling in many of the dairying districts of this State is fully realised; but it is nevertheless considered that much more could be attempted by progressive farmers than is usually done at present. The provision of a trough, or the use of a surface cooler, enables a proper cooling of the cream to be effected immediately it is separated. The writer has inspected records kept by farmers who have installed coolers, and in every instance it was observed that, even on the hottest days, the cream rarely rose more than a few degrees over 70° F.

A significant fact also was that, since the adoption of cooling, second-grade cream has been unknown. A cheap cooler can be procured from factories or stores in dairying districts for about £2. The importance of keeping cream at from 60 to 70° F. lies in the fact that the lactic acid bacteria which are required to bring about the desired ripening of cream are most favoured by this temperature range, their growth being so rapid that other species are gradually destroyed, or are prevented from multiplying. At higher temperatures many undesirable bacteria are able to compete with the lactic acid bacteria, resulting in the development of "off" flavours, such as gassy, yeasty, rancid, cheesy, and unclean or tainted cream.

Transit to Factory.

During its transit to the factory the cream should be protected from direct sunlight in waggons which are covered by a suitable hood. The development of tallowy and metallic flavours is accelerated by heat

and sunlight. Direct sunlight will turn milk tallowy in ten minutes; and in diffused light the taint will sometimes appear in forty-five minutes. Cream should not be conveyed in waggons which are also used to carry odoriferous products, owing to the ease with which cream will absorb odours from its surroundings.

Faulty Containers.

Faulty cans are a menace to the cream contained in them. Badly dented, rusty cans, or cans from which the tinning has worn off, will quickly deteriorate their contents. Their influence can be gauged from recent research in England which has shown that 0·2 parts of copper, or 2·0 parts of iron, per million will affect the flavour of butter. In this connection, the harmful effect of using kerosene tins on the dairy is often overlooked. In addition to the possibility of inducing metallic flavour, bacteria which lodge in the seams of these tins are injurious to quality.

Anyone who will use reasonable care can produce milk or cream of choice quality. Elaborate equipment is not necessary, but simply an understanding of the methods of preventing contamination from various sources.

FEEDING ON THE DAIRY FARM.

Finely-ground cereals should be used in the early stages of a calf's life. Under the systems for the rearing of calves in Queensland, the cereal meal is first introduced into the ration about the second or third week. As the animal grows, and is better able to cope with it, the grain may be less finely ground; and, by the end of the third month, only the very hard grains require crushing. The first year of a calf's life is the period in which it masticates most thoroughly. From then on, the proportion of whole grain that passes through undigested gradually increases. The reverse is true of the roughages. It rarely pays to chaff or mill hay for calves.

With the milking cow productivity may govern the method of preparing the food. Further, when certain foods which are normally ground or crushed are low in price, the extra production which results from grinding may not pay for the cost. An exception must be made when stock are being prepared for exhibition or test.

It is a safe rule always to crush corn. All concentrates for high-producing cows should be in meal form. This does not mean that the food must be powdery. Excessively fine meals are usually dusty, and unless moistened with molasses or water, they are wasteful; furthermore, the irritation they cause when taken in with the breath may actually induce a dislike for a good food.

Roughages are usually fed uncut. Stalky or unpalatable roughage may be chaffed to encourage consumption or to make the inclusion of a concentrate simpler. Food which is to be moistened with molasses should be chaffed.

The fine chaffing of hay for dairy cattle is not justified even for stud or exhibition cattle, as it impairs digestibility by suppressing rumination. Whole plant feeding is often employed, e.g., corn and sorghums. The coarse chaffing of the sweet sorghums is necessary. Grain crops require better treatment—it may even pay to chaff, though as a rule whole plant feeding of cereals should be done as silage.

How to Keep Churns Sweet.

J. D. OGILVIE, Dairy Instructor.

Butter absorbs foreign odours very rapidly. If the churn is not kept in a pure and sweet condition, the butter will be exposed to undesirable odours and its commercial quality will be impaired. The best cream will not produce a high-grade butter if a foul-smelling churn is used.

A churn should be given two rinsings at the conclusion of each day's churning—the first with lukewarm water, and the second with scalding hot water.

Some butter-makers turn the churn over with the cover hole down; others prefer to have the cover hole turned up. When the churn is turned with the cover hole down, the remaining steam on the inside of the churn cannot escape. It will condense inside the churn, and cause it to remain in a damp condition overnight. If, however, the churn is turned with the cover hole up, the dust and other impurities, if present, are likely to settle in the churn.

The best method is to turn the churn over so that the cover hole points to one side. The steam then can escape, and the heat absorbed from the boiling wash water will dry the churn thoroughly. The churn, however, should be drained thoroughly first, as otherwise some water will remain in the bottom.

Some makers rinse the churn only once and use scalding hot water. This method is likely to scald the remaining curd on to the wood. One rinsing is not enough to ensure a clean churn. The first rinsing with lukewarm water removes the major portion of the buttermilk and brine, and, to a certain extent, warms and preheats the wood of the churn, so that when the second rinsing with scalding water is completed, the churn receives the full benefit of the scalding. In addition, the churn is clean and no food on which germs can thrive is left. The churn is left warm, and in that condition will dry out quickly. If the churn is cleansed in the manner described above, and then, at the end of the week, treated with freshly slaked lime, it can be kept in a sweet condition.

A bucketful or two of the liquid lime will be sufficient for each churn. If the churn is rotated a few times, the lime will spread over the inside of it. The churn should be allowed to remain in this condition until ready for use again. Before it is used again, some warm water should be put into it, and the lime will readily come off; but, if it has been allowed to remain in the churn too long, it will form a lime carbonate and will be more difficult to remove. Lime is the safest and one of the best disinfectants and deodorants that can be used in a factory. Some factories use it every day on all wooden utensils, such as butter workers and packers.

COTTON.

The harvesting of cotton is still in progress, but most of the consignments now being received at the ginneries consist of scrap cotton, an indication that the season is drawing to its close. Considering the extremely dry conditions that ruled throughout most of the cotton areas until December, and the long periods of excessive heat which followed, the quality of the cotton picked this season has been remarkably good. There was considerably less of the yellow-spotted grades, and an increase in the percentage of mature grades, particularly in the case of the newer hard-bodied varieties of medium staple. As this class of cotton is required by the Australian spinners, the progress made with these varieties is of special importance.

Steady, soaking rain is urgently required in all cotton areas to allow of the preparation of seedbeds, and to replenish subsoil moisture, a most important factor in the successful growing of cotton, because of the deep-rooting system of the plant.

The distribution of seed has commenced, and applications are coming in steadily.

SUGAR.

During the early part of July, rather cool, dry conditions prevailed in all cane areas; this checked effectively the growth of the mature crop, while frost caused slight damage to young cane in isolated areas.

Good rains were experienced in the far North during late July, while the drought conditions in the southern districts still persist.

Many of the mills are now in operation, and the cane is generally above normal in sugar content. Crops appear to be cutting up to estimate, so that there appears every possibility of a 700,000-ton sugar crop.

A Tractor Operated by Suction Gas.*

G. A. CHRISTIE.

HITHERTO the use of suction or *producer* gas has been confined, more or less, to stationary engines. Attempts have been made to design a suitable generator for use with motor vehicles, and these have proved satisfactory under certain conditions; now a farm tractor which has been designed to use producer gas as the explosive mixture has been manufactured by the Howard Auto Cultivator Works.

The principle of operation is that a mixture of combustible gases is formed when charcoal which has been moistened is burnt in a limited supply of air. In the same way that petrol vapour ignites with a spark when mixed with air, so producer gas burns and expands, to provide the power stroke of the engine. In designing the gas generator (see plate 56) the manufacturers have endeavoured to combine efficiency in working with economy of space and ease in operation.

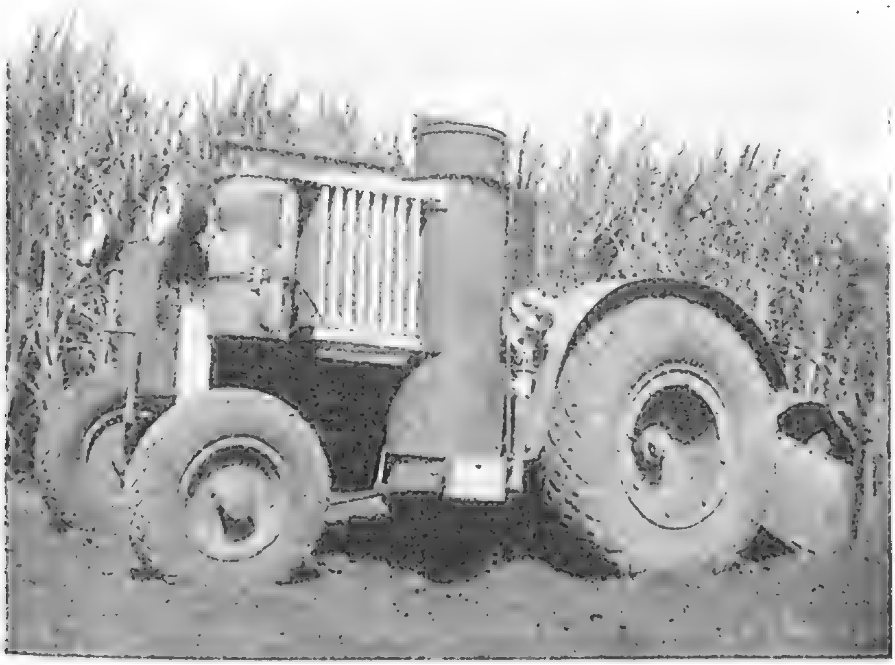


Plate 58.

Illustrating the Tractor operated by Suction Gas.

The tractor, which develops 40 horse-power, is fitted with a 5-feet rotary hoe; this is easily detachable and the tractor may be used as a stationary engine, or any other implement may be attached for cultivation purposes. The hydraulic lift by which the hoe is raised is rapid in

* From *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations) for July, 1937.

action, and thus allows cultivation to be carried closer to headlands than is the case with a slower type of lift. The tractor is fitted with a full set of pneumatic tyres, which enables it to be driven with comfort, and without any adjustment, over highways. It is also claimed that they give a higher general efficiency in operation. The unit is fitted with self-starter and headlights, the power for which is developed through a 12-volt battery.

Before starting any tractor it is necessary to check the various oil and water levels, to grease the several points, &c., which jobs usually occupy about twenty minutes. With the suction gas tractor, it is found that if the fire is started before commencing this work, gas may be produced by the time the examination is complete. Thus the period elapsing between lighting up and the operation of the engine on gas is not more than thirty minutes. The engine is started on petrol, and is gradually switched over to the gas. This phase occupies only four or five minutes at each starting. The producer is refilled with charcoal at intervals of one hour, and since the engine is not stopped, very little time is taken up in that operation.

Plate 59.

Suction Gas Tractor with Rotary Hoe Attachment.

Since its introduction to the Bundaberg area, Messrs. Douglas Bros., of South Kalkie, have kept accurate records of all costs of operation. The tractor and rotary hoe have been used in ratooning cane, cutting and turning under trash and green manure crops, and in normal cultivation of fallow land. The average depth of working (except in ratooning) is 9 to 10 inches of firm soil. In the 233 hours

of operation, 140 acres have been cultivated with the following operating costs:—

	£	s.	d.
Charcoal—187 bags at 1s. per bag	9	7	0
Lubricating oil—changed every 40 hours—12 gallons at 5s. 5½d. per gallon	3	5	6
Petrol for starting—9 gallons at 1s. 10½d. per gallon	0	16	11
Gear lubricant	2	9	6
Total	£15	18	11

It will be seen that the running costs per acre with the rotary hoe have been less than 2s. 3½d., while the hourly cost of operation is less than 1s. 4½d., excluding the wages of the driver. From these figures it will readily be appreciated that suction gas may be employed profitably in farm tractors, without any loss of efficiency, where a plentiful supply of cheap wood for charcoal production is available.

MEATWORKS BY-PRODUCTS.

Meatworks by-products are all of organic origin, and vary in composition with the part or parts of the animal used in their preparation.

Blood is used either as a foodstuff (blood meal) or as a fertilizer (dried blood), depending on the quality of the manufactured product. Blood meal is not available on the Queensland market and requires no discussion here. Dried blood contains 81 per cent. crude protein (nitrogen 13 per cent), and other organic matter plus moisture 19 per cent. It is a widely-used nitrogenous fertilizer, comparable in many respects with sulphate of ammonia in the rapidity with which the nitrogen is available to the plant.

Bone is finely ground in the preparation of bone flour, bone meal, and bone dust. An average quality bone dust contains crude protein 22 per cent. (3½ per cent. of nitrogen), tricalcic phosphate 50 per cent. (23 per cent. phosphoric acid), and other organic matter plus moisture 28 per cent. Bone dust is a slow-acting phosphatic manure. The more highly-refined products find an outlet as a constituent in many stock licks, which are valuable for stock grazing on phosphate deficient soils.

Waste flesh is the basis of meat meal, the dried residues being finely ground. It invariably contains a certain amount of bone. Meat meal (crude protein 63 per cent.), like blood meal, is an excellent protein concentrate for stock and the available supplies are readily absorbed on the Queensland market. It also contains fat. When used for fertilizer purposes, the fat is first extracted during preparation.

Meatworks manure is a mixed product containing blood, bone, and waste flesh. It contains approximately 6 to 3 per cent. nitrogen and 14 to 23 per cent. phosphoric acid, and is widely used in the State. It should be noted that as the nitrogen increases the phosphoric acid decreases, and *vice versa*.

All bone flour, bone meal, and meat meal products used for feeding animals must be subjected to a steam heat at a temperature of not less than 250 deg. F., equal to an indicated steam pressure of 30 lb. per square inch for at least two hours during the manufacturing process. They must be prepared only from animals slaughtered for human consumption.

F. C. Coleman, Dairy Branch.

Summer Fodder Crops in the Maranoa.

C. H. DEFRIES, Instructor in Agriculture.

THE possibilities of summer hay and fodder crops for early spring planting, if the weather is favourable, are now engaging the attention of farmers in the Maranoa district. Land for such crops should, of course, be prepared now. Ploughing may be impracticable until it rains, but there are many paddocks already prepared for wheat which could not be sown during the dry weather. When replanting these areas it would be advantageous to reserve at least a portion of the area for summer fodder crops.

Pre-eminent among the fodders suited to the district is Sudan grass. The risk of prussic-acid poisoning associated with this crop can be reduced by purchasing seed from a reliable source to ensure freedom from contamination by the more toxic sorghums. Careful grazing is also necessary. Stock should not be fed on young crops, or crops which have been checked in any way during growth. It is also inadvisable to turn hungry cattle into a Sudan grass paddock.

Plate 60.

CUTTING A HEAVY CROP OF SUDAN GRASS.—A harvesting scene on a Central-Western pastoral holding on which fodder cultivation is practised extensively.

Good quality hay can be made from Sudan grass in the Maranoa, and it constitutes a valuable standby for all stockowners during winter or other dry periods. Fine-stemmed plants are preferred by stock, and facilitate both harvesting and curing the hay. For this reason, wide drills which strain the cutting mechanism of a mower or binder and tend to develop coarse plants should be avoided. Planting with the wheat drill, at the usual spacing for wheat, gives excellent results if the seed is sown at the rate of 7 lb. per acre.

As a quick-growing crop Japanese millet is coming into wider cultivation on the better loams of the eastern portion of the district.

The crop may be grazed when quite young, and in feeding off there is no risk of stock poisoning. For best results, however, it is wise to allow growth up to 9 to 12 inches. The hay is good, although yields are not so heavy as Sudan grass; 10 to 12 lb. per acre is the usual sowing.

Plate 61.

A FIELD OF SUDAN GRASS.—A crop grown for fodder on Coreena, a pastoral property near Barcaldine.

West of the Darling Downs cowpeas are not in general use for fodder or hay, although they do well enough on the lighter soil types and form a very useful supplement to other fodders. Stock often show a dislike to the fresh green growth when they are not used to it, but eat it readily when cut. The value of this legume in supplying a protein supplement when fed with native pasture, and its capacity to enrich the soil through the action of nitrogen fixing bacteria in the nodules of the roots, should not be overlooked—particularly in sandy soils where native legumes are of little consequence.

Broadcast sowings of half a bushel are usually made with small seeded peas such as Poona. When sown in rows, 8-10 lbs. of seed is sufficient.

GROW COTTON.

Cotton growing in the south-eastern portion of Queensland is at the present time in an unique position, as it represents one of the few primary commodities for which there is an unfulfilled demand in Australia. Since the last Commonwealth Bounty Act came into operation, there has been a rapid expansion in the cotton spinning and manufacturing industries in Australia, with a resultant increased demand for raw cotton.

The cotton industry is established on a co-operative basis and is one of the few industries in which the product grown is handled by the

growers' organisation from the field to the manufacturer. This organisation, the Queensland Cotton Board, takes control of the seed cotton when it leaves the farm, transports it to the nearest ginnery, gins the cotton, markets the lint, and manufactures by-products, all the resultant profits being returned to the grower.

For the past two seasons the average return paid to growers for seed cotton delivered at their nearest railway station has been approximately 4d. per lb. of seed cotton, and, considering the increased demand by the farmers for the high lint percentage cottons, it is assumed that the average net return of 4d. per lb. will be maintained at least for the next three years.

The advantages of cotton as a rotational crop in any farm system, and especially in conjunction with dairying, should appeal to most farmers and primary producers. Over a number of years, cotton has proved its adaptability to the conditions within the cotton belt and can be successfully grown on most of the main soil types within this area. It undoubtedly offers distinct advantages over many other crops on account of its drought-resistant qualities, and in the past two seasons, which have been particularly severe ones, profitable yields have been obtained where other crops failed or gave only poor returns.

The suitability of cultivations newly broken up out of the original grasslands has been studied carefully for several years, and it is obvious that substantial benefits are obtained on most soils when cotton is grown in rotation with pastures of a sufficient stage of establishment. The benefits which may be expected can be grouped under three headings—increased yield per acre, improvement in lint quality, and reduced costs of production.

Observations have definitely shown that new cultivations, or recently ploughed Rhodes grass paddocks, produce heavier yields of lint cotton than do adjacent cultivations on which crops of cotton have been grown for more than five years in succession. The explanation of the increased yields may be found in several factors. The more important are the restriction of the soluble plant food nitrate-nitrogen in the soil to levels most suitable for the cotton plant and the maintenance of adequate supplies of organic matter (roots, leaves, stems, &c.). The latter prevents the soil particles from packing and gives to the soil an open texture that allows of the quick and complete absorption of ordinary storm rains.

Another important feature of the pasture-cotton rotation is the reduction of production costs, brought about by the lessened number of workings required to keep the field clean in the first three or four seasons after being brought under cotton. Weed and grass growth is less, and the surface does not become compact with the occurrence of heavy rains.

To establish the Queensland cotton growing industry on a firm basis, it is incumbent upon the growers to supply fully the requirements of the spinners, and to accomplish this increased areas are necessary. When the general suitability of cotton for most of the soil types of the south-eastern portion of this State is considered, it becomes all the more apparent that growers cannot afford to exclude cotton from their system of farm cropping.

R. W. Peters.

In Memoriam.

ALFRED ERNEST GIBSON.

OF the late Mr. Alfred Ernest Gibson, Director of Agriculture in Queensland, whose death occurred at his home at Manly (Q.) on 8th July, it may be said with truth that his life was one of devoted service to the State. His illness had been a protracted one, and the end was not unexpected; but, nevertheless, the news of his demise came as a shock to his friends and associates in the Department of Agriculture and Stock, by whom he was held in high esteem and affection. The intimation of Mr. Gibson's death also called forth expressions of deep regret from primary producers in various parts of Queensland who had learnt to appreciate his merits as an authority on agricultural methods, as well as his fine qualities as a man.

Born in Victoria in 1873, the late Mr. Gibson graduated as Dux of his year from the Dookie Agricultural College in that State in 1890. He gained a varied experience as manager of butter factories in Victoria, as manager of sheep properties in the western part of that State, and in dairying, general farming, and fruit-growing. Before coming to Queensland, he was engaged in farming on his own account in the Maffra district in North Gippsland. He left for Queensland in 1909 and joined his brother, a surveyor, in the field study of soils, grasses, and timbers in the central-western portion of the State.

In 1911 Mr. Gibson accepted an appointment in the Department of Agriculture and Stock as farm foreman at the Queensland Agricultural College, Gatton. Two years later he was promoted to the position of overseer and experimentalist at the college. He was appointed instructor in agriculture, with headquarters in Brisbane, in 1914, and fourteen years later became senior instructor. In 1933 he was appointed Acting Director of Agriculture, an appointment which was subsequently confirmed. Mr. Gibson also acted as deputy for the Director of Marketing on various commodity boards, and was a Government representative on the executive of the Council of Agriculture.

The announcement of Mr. Gibson's election for the position of Director of Agriculture in 1933 was received with approbation by the primary producers throughout Queensland, because there was a general feeling of confidence in his ability to discharge

Plate 62.
THE LATE A. E. GIBSON, DIRECTOR OF AGRICULTURE.

satisfactorily the onerous duties of the position. It was widely recognised that Mr. Gibson had a thorough knowledge of agricultural science and practice which fitted him for the task of directing the activities of so important a branch of the Department of Agriculture and Stock.

Devotion to duty, earnestness, thoroughness, and a keen personal interest in the work on which he was engaged were outstanding characteristics of the late Mr. Gibson. His mind was essentially practical and efficiency was his primary aim. Allied with these admirable attributes was an unassuming and tolerant attitude to all with whom his duties brought him into contact. At no time did he attempt to dictate to the man on the land as to what he should do, but he sought to help him with advice which he was ready always to justify and support by logical reasoning. In this way he was able to inspire confidence as a practical man whose guidance in respect to the varied and complex problems associated with the growing of crops and the care of domestic animals might safely be followed. His home and his garden, fishing and cruising on Moreton Bay in his fine power yacht—the work of his own hands and a triumph of the boat builder's craft—were "Gibby's" leisure-time hobbies.

TRIBUTE BY THE PREMIER.

The Premier (the Hon. W. Forgan Smith, LL.D.), on behalf of the Government, tendered sympathy to Mr. Gibson's widow and family in their bereavement. The deceased gentleman had given many years of valued service to Queensland, he said, and up to the time of his death he was directing many experiments of great potential value to primary producers, and his loss would be felt severely.

MR. BULCOCK'S EULOGY

"It is with deep sorrow that I learnt of the death of Mr. Gibson," said the Minister for Agriculture and Stock (the Hon. Frank W. Bulcock).

"Mr. Gibson joined our service in 1911, and during the whole of his association with the department he made material contributions to the well-being of agriculture. Many farmers settled throughout Queensland will have kindly recollections of Mr. Gibson as an instructor and experimentalist at the Gatton

Agricultural College. Later, in his associations with experimental work, he achieved a degree of success which few people gain in the services of agriculture.

"Mr. Gibson was actively associated with the economic side of the industry and was Government representative on several pool boards, the more important of which were the wheat pool and the plywood and veneer pool. Here his business acumen and long association with farming problems enabled him to make very valuable contributions to economic organisations associated with this department.

"I feel that not only have I lost a very valuable officer, but one whose counsel was always sound and worthy of serious consideration.

"Last year Mr. Gibson fell ill, and some doubt was expressed about the possibility of his recovery, but, while he was still a very sick man, he insisted upon returning to the department to carry on his duties. During his recent illness every unit of the Service, including myself, felt his absence greatly.

"Mr. Gibson's work for agriculture has made his name a family word wherever farming problems are discussed, not only in Queensland but in agricultural councils throughout Australia.

"I can only offer my very sincere sympathy to his widow and family."

Flags were flown at half-mast over the head office of the Department of Agriculture and Stock in Brisbane and at branches throughout the State on the day on which Mr. Gibson's death was announced and on the day of the funeral. After a brief Service at his home, the interment took place in the beautiful bushland cemetery at Hemmant, in the presence of a large gathering of his friends and former associates, among whom were representatives of the State Government and Parliament, of every branch of the Department of Agriculture and Stock, of the Council of Agriculture and associated farmers' organisations, of the Royal National Agricultural Association, of the Faculty of Agriculture within the University of Queensland, of the Ex-Students' Association of the Queensland Agricultural College, and of the commercial life of the city. He left a widow, two daughters, and a son to mourn their loss.

Some Tropical Fruits.

No. 16—THE GRANADILLA.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

TWO very similar fruits are known by this title—namely, *Passiflora quadrangularis* and *Passiflora macrocarpa.* Both are commonly grown in North Queensland, although the former is of the greater commercial value, and consequently more frequently met with in orchards. The latter is more favoured by home gardeners.

P. quadrangularis produces a fruit about 6 to 8 inches in length and 3 to 4 inches in diameter. *P. macrocarpa* fruit is usually about 12 inches long by 5 to 7 inches in diameter.

The formation of both fruit is similar. Underlying a very thin translucent skin is a layer of greenish coloured flesh, about an inch in thickness in the *quadrangularis,* and 1½ inches in the *macrocarpa.* The inner surface of the flesh is covered with a parchment-like skin, thus leaving a fairly extensive cavity in the centre of the fruit. This cavity contains a large number of flattish seeds, each of which is in a separate pulpy sac. *P. quadrangularis* contains comparatively more pulp than *P. macrocarpa,* and this constitutes the edible portion of that variety, the flesh usually being too dry, mealy, and tasteless to be palatable. In *P. macrocarpa,* however, the flesh is crisp and juicy and has a flavour quite distinct from that of the seed pulp. With the addition of a little orange juice and sugar a very tasty fruit salad may be made by scooping out and mixing the seed pulp and flesh of this fruit alone.

Vines of Similar Habit.

The two granadillas, usually known as small-fruited and large-fruited to distinguish them, are strong-growing vines of similar habit, growth and appearance. The stems are sharply four-angled, the leaves

are large, entire, ovate, light yellow-green in colour and 6 to 8 inches long. The flowers are large, 4 to 6 inches across, purple and white in colour, with three prominent stigmas and five stamens, and they are strongly and peculiarly scented.

Flowers are produced in small numbers throughout the year and odd fruits are always available. The main fruiting season, however, is during the autumn and winter months, from April onwards, during which time the vines are heavily laden with flowers and fruit in all stages of growth. At this season one of the main reasons for the greater popularity of *P. quadrangularis* with orchardists may readily be understood. Whereas a *P. macrocarpa* vine may carry ten to twelve fruit, *P. quadrangularis* may carry as many dozens of smaller fruit, in the season.

The granadilla is not very particular as regards soil. It has been noted growing quite luxuriantly on volcanic, alluvial, sandy, and decomposed granite soils. It grows on either jungle or open forest soils, but on the latter, which are often deficient in organic matter, the vines show considerable benefit from mulching.

In the jungle areas of North Queensland the vine may often be seen in a flourishing state, thus demonstrating the suitability of our tropical soils and climatic conditions to its growth.

This plant is essentially a tropical one, and although it grows and fruits in the southern latitudes of Queensland, it is only within the tropical area that it is seen growing to perfection. It is susceptible to damage by frost; hence the careful selection of a site is necessary in the sub-tropics. Within the tropics, however, no such consideration is necessary, and the rich profusion of vine and fruit produced by the granadilla in such localities as the Cairns district is ample proof of its tropic-loving propensities.

Seed or Cuttings.

The granadilla may be propagated from either seed or cutting. Seed germinates readily provided it is fresh, but the cutting is recommended on account of its more rapid growth.

Suitable cuttings may be taken from lateral growths and should be not less than 15 inches long, but may be 2 or 3 feet long with advantage. In the tropics, when the planting is done during the rainy season, it is found that cuttings strike more readily if the leaves are not removed from the portion above the ground. This should be one-third to one-half the total length of the cutting. The remaining lower portion should have the leaves removed and should be inserted horizontally or diagonally in a bed of well-prepared loamy soil. They should be planted in their permanent positions in the field at the foot of the trellis posts. It is advisable to plant two cuttings in each bed in case of failures and, should both strike, one may be removed later.

The vines are grown over a trellis support. The type most favoured and giving the best results is that known as a horizontal trellis. It is erected on stout hardwood, bean, or white beech posts, spaced 10 feet apart, in two lines also 10 feet apart. The posts should be 7 feet clear of the ground to allow good head room. They support a strong frame of split rails or heavy saplings placed on their tops, the rails being connected by cross saplings at intervals of about 4 feet. Plain galvanised wire of No. 8 gauge is then run along the trellis, over the saplings at

15 inches intervals, thus forming a horizontal network of wires and saplings. Such a trellis is known as a granadilla shed. It may be built to any convenient length, and the width may be increased by adding extra rows of posts and trellis work.

Plate 63.

GRANADILLA CUTTINGS PREPARED FOR PLANTING.—*a a* Cuttings prepared for dry season and southern planting. *bb* Cuttings prepared for rainy season planting.

Vines may be planted at the foot of every post; but, after the first fruiting, or as soon as the vines become too thick, every second plant should be cut out.

When raising the young vines it will be found that growth is greatly increased by providing small twiggy sticks such as thin bamboos with laterals intact pushed into the ground against the posts for the vines to cling to. As soon as they reach the top of the posts a few light, twiggy branches thrown over the top of the trellis assists the rapid spread of the vines; and, provided they are light enough, such branches soon rot away after they have served their purpose and do not encumber the trellis.

A modified form of trellis is one in which only one supporting row of posts is erected and cross-arms of 2 or 3 feet in length are affixed to the posts, three or four wires being then run through the

cross-arms. This type of trellis is not often met with; and while it may be suitable in localities where the growth of vine is restricted, it is not to be recommended for the tropics, both because of the insufficient area of trellis to hold the vine, and the poor support offered to heavily laden vines. Such insufficient support results in the tearing away of portions of the vine by the weight of the fruit, and the consequent loss of the fruit.

Plate 64.
Granadilla shed carrying twelve-month-old vines.

The fruit is ready for harvesting when the skin becomes clear, transparent, and glossy, and the apex shows a tendency towards yellowing. It should then be clipped from the vine and carefully placed in picking baskets or boxes lined with bagging. Chinese baskets make good picking containers, being light to handle, yet stout.

In packing for market each fruit is wrapped in a sheet of paper, and woodwool packing should be used to cushion the fruit and prevent bruising. Either the standard bushel or one and one-half bushel case is a suitable container.

In many localities natural pollination of the granadilla does not take place and artificial pollination must be resorted to, to obtain a crop. This is simply effected by gathering the ripe pollen with a feather or camelhair brush and placing it on the stigma of another flower. The cross pollination is necessary because of the protandrous habit of the granadilla that is, the ripening of the pollen in a flower before the stigma has matured and is ready to receive it.

The granadilla normally prunes itself by the dying back of the lateral growths after they have produced their crops. Hand pruning may be resorted to with advantage, however, and is sometimes necessary during the fruiting season, in cases in which the growth may be too dense.

Very little experimental work has yet been carried out with respect to the artificial manuring of the granadilla; consequently, no definite recommendation can be made in this respect. However, until more work has been done, the fertilizer recommended for the passion fruit could probably be used with advantage. The mixture recommended by the late J. C. Brunnich for that plant contains 1 to 2 cwt. nitrate of soda, 4 to 8 cwt. blood and bone, 1 to 2 cwt. superphosphate, and 1 to 2 cwt. sulphate of potash, which corresponds to a 7-10-10 mixture. He recommended also a top dressing of 1 cwt. of nitrate of soda per acre, to be applied in the spring.

Plate 65.
The granadilla flower.

Probably the most destructive pest of the granadilla is the green vegetable bug (*Nezara viridula*), which at times destroys numerous young fruits by puncturing and sucking the juices from them. Young fruits so attacked frequently wither and fall, whilst in more mature fruit hard lumps are formed in the flesh.

The treatment recommended for this pest is a spray consisting of 10 lb. resin, 2 lb. caustic soda, 3 lb. fish oil, and 40 gallons water.

Fruit fly and several species of beetles have also been known to attack the fruit at times. The method of control adopted against all these pests usually consists of enclosing the fruit, from quite an early

Plate 66.
Good specimens of *P. quadrangularis*.

stage of growth, in paper bags, the tops of which are tied closely round the stems. Ordinary brown paper bags have been found fairly satisfactory for this purpose. The use of such bags, however, necessitates their removal to ascertain whether the fruit is ready to pick. Furthermore, they tend to become waterlogged and torn in wet weather. A suggestion has been put forward that celophane bags might be an improvement; and, following this up, a small experiment is now under way to ascertain what advantages, if any, these may have over ordinary brown paper bags.

Diseases observed up to the present have been a leaf spot and a black fruit spot, but so far they have not been regarded as serious.

Plate 67.
Granadilla attacked by the Green Vegetable Bug, *Nezara viridula.*

CULINARY USES.

The granadilla has several culinary uses, and the following recipes may be found worth while:—

Granadilla Fruit Salad.—Take one granadilla of the large variety, cut in half and scoop the seed pulp into a dish. Remove and discard the inner skin, then scrape out the flesh with a fork. Add the flesh to the seed pulp and stir in one half-cup of sugar. A little orange juice may be added, if desired. Set aside for about three hours and serve with or without cream as desired. (Note: The small-fruited variety of granadilla is useless for the above salad).

Granadilla Pie.—Scoop the seed pulp from a ripe granadilla and add about one-half cup of sugar. Remove the outer and inner skins from the flesh, cut it into cubes and place in a saucepan with sufficient water to cover it. Let it simmer until tender (about half an hour). Place the stewed flesh and raw seed pulp in a pie dish and cover with a short pie crust. Bake in a hot oven.

Granadilla Jelly.—Wash the granadillas and cut out all skin blemishes. Cut up the flesh without peeling, and put in a saucepan with sufficient water to cover. Boil for two hours. Place the seed pulp

in a separate saucepan with a little water, and allow it to simmer on the side of the stove. Strain both lots through a fine cloth into another saucepan. To each cup of juice add three-quarters of a cup of sugar, and for each granadilla use the juice of one lemon. Place back on the stove and boil until it jellies.

Plate 68.

A mature granadilla shed carrying a good crop of fruit.

Granadilla Wine.—To make 5 gallons of wine, mash ten granadillas, fully ripe, and cover well with water in an earthenware or wooden vessel. Let it stand for forty-eight hours, then strain off. Dissolve 10 to 12 lb. sugar in hot water, and add to the juice while warm, adding sufficient more warm water to make up 5½ gallons of liquor. Pour into a cask and keep the extra half-gallon aside for filling as the fermentative process reduces the level of the wine each day. When fermentation is finished, which should be in about three weeks, 2 pints of brandy may be added and the bung driven home. The wine may be bottled off in nine to twelve months.

Grapefruit.

R. L. PREST, Instructor in Fruit Culture.

GRAPEFRUIT, the commercial or trade name given to the pomelo—*Citrus paradisi*—is credited with having arisen from the tendency of the tree to bear its fruit in clusters, and it is unlikely that it will ever be superseded by the correct horticultural term, pomelo.

Plate 69.
Marsh Grapefruit.

The tree is a vigorous grower, handsome and symmetrical, with a rounded or conical head. The bark is of a smooth greyish-brown colour. The foliage, when mature, is a dark glossy green; whilst the young shoots and leaves are smooth and light-green in colour. The leaves are ovate, blunt, pointed or rounded, smooth and leathery, and the margin crenate, the petioles being broadly winged. The flowers are produced singly or in cymose clusters, and are sweet scented, the calyx being large and the sepals four or five in number and pointed. The corolla is white, and the petals, four or five, slightly reflexed and fleshy. There are from twenty to twenty-five stamens, the anthers being large and the pistil stout. The stigma is covered with a sticky milky fluid when ripe, and the ovaries number eleven to fourteen.

The fruit is large, oblate, globose, and may be pyriform when from out of season blossom; colour light-lemon to pale-orange; flesh greyish or pink; juice sacs large, spindle shaped and closely packed

together. The flavour is a blending of bitter, sweet and acid; the seeds being large, light coloured, wedge shaped or irregular; and the cotyledons white.

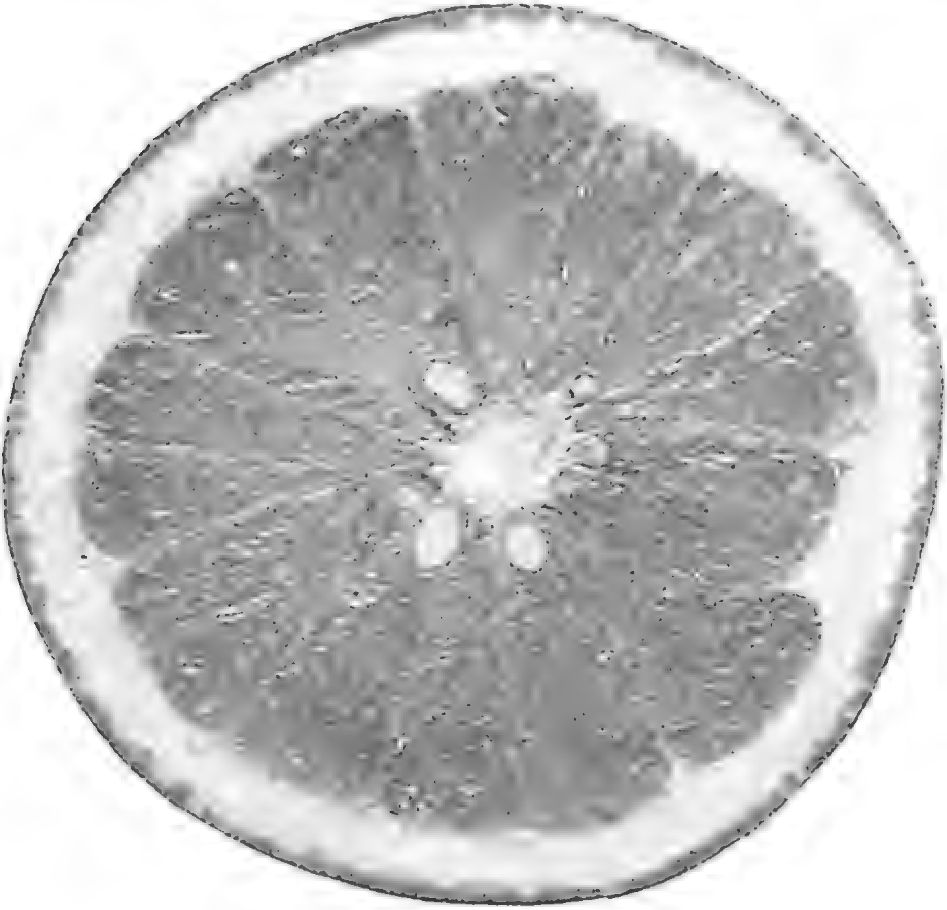


Plate 70.
Cross-section—Marsh Grapefruit.

As a breakfast fruit the pomelo, or grapefruit, is without equal, and in America it is a common and much-sought-after breakfast dish. In Australia, it is not quite so well known, though in the Southern States, and latterly in Queensland, the demand for it is steadily increasing. On the Brisbane market the popularity of this desirable breakfast fruit has been somewhat retarded by the sales of bitter-sweet and sour oranges under the name of grapefruit. This practice is being discouraged, and purchasers are advised to look for a pale-lemon colour in the fruits offered for sale as grapefruit.

Besides being an excellent appetiser, the grapefruit is credited with having tonic properties. The flavour of the ideal fruit is pleasant yet indescribable; and, as previously stated, a blend of bitter, sweet and acid. Lacking this, it falls short of its high standard and can only be classed as inferior.

The bitter principle is contained in the partitions of the fruit. Some connoisseurs contend that it would be better if this were eliminated, and consider that those varieties in which the bitterness is nearly

absent are preferable. It should, however, be realised that without the bitter principle the fruit would not be a pomelo. In quality fruits the bitterness should be rather prominent.

Varieties that have done well in Queensland are:—

Marsh Seedless:—Form oblate; roundish; colour pale lemon-yellow; medium thick rind; smooth; sections thirteen; regular; juice sacs small; flesh greyish-green; flavour good, bitter principle not very pronounced; acidity and sweetness good; seeds none to six, large, plump; midseason.

Plate 71.
Duncan Grapefruit.

Duncan:—Form oblate; colour pale lemon-yellow; rind smooth; sections fourteen; large; bitter principle well-marked; acidity and sweetness good; quality very good; seeds about 50, large, plump, blunt; midseason.

Fosters:—Form oblate; colour pale-yellow; rind smooth; sections thirteen; large; bitter principle strongly marked; acidity and sweetness good; quality very good; flesh pinkish; seeds about 60, large, plump, wedge-shaped or irregular; season early.

Triumph:—Form oblate or oblate oblong, somewhat flattened at base; colour light-yellow; rind very smooth; sections eleven; bitter principle not strongly marked; acidity and sweetness good; seeds 37; medium, plump, roundish; season medium early.

Though Marsh Seedless at present holds pride of place, chiefly on account of its having only a few seeds, the high quality of such varieties as Duncan, Foster, and Myrther, in spite of their seediness, cannot

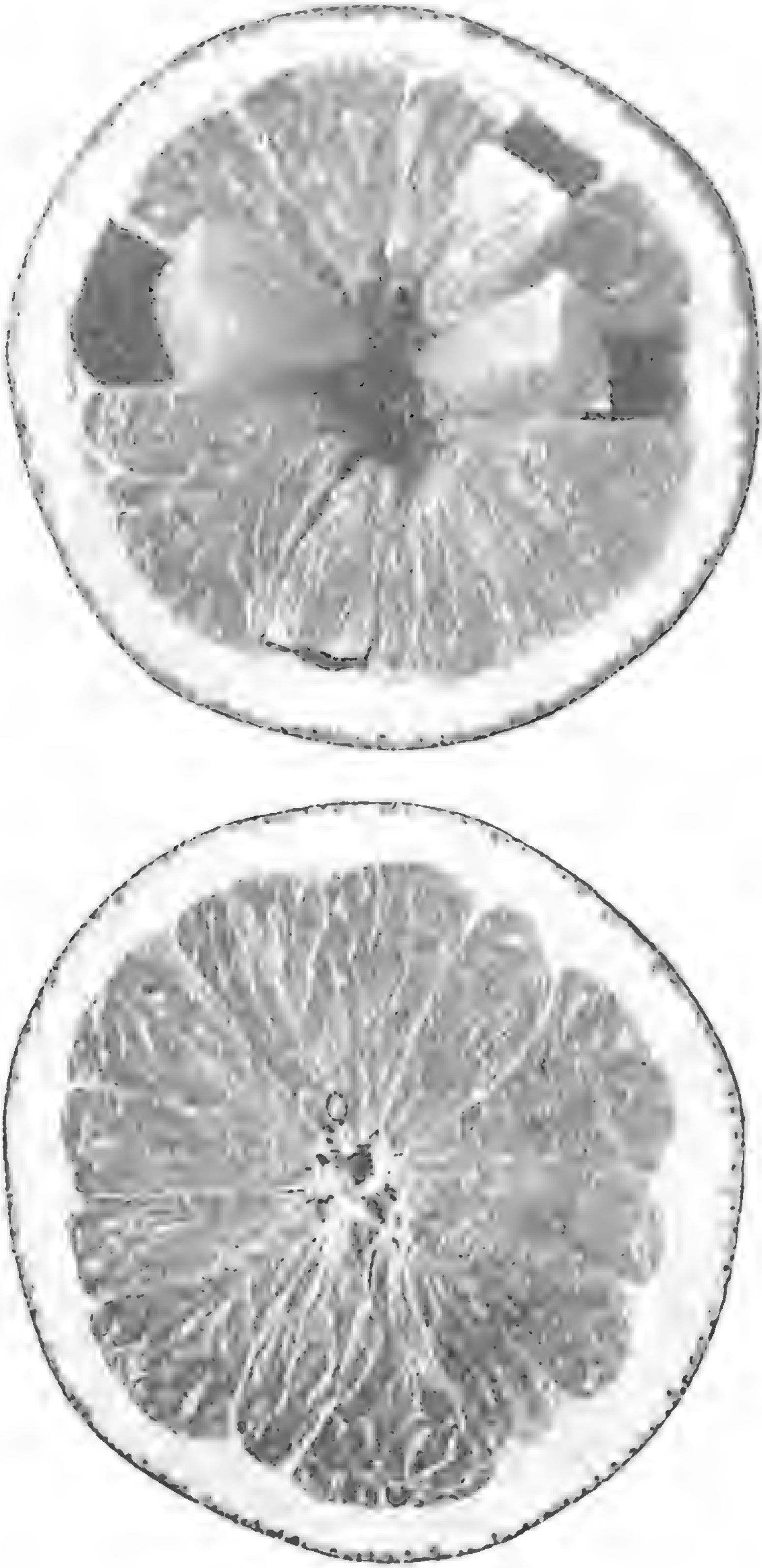


Plate 72.
Preparing a grapefruit for table.

be denied, and they require little, or no greater, trouble to prepare for the table.

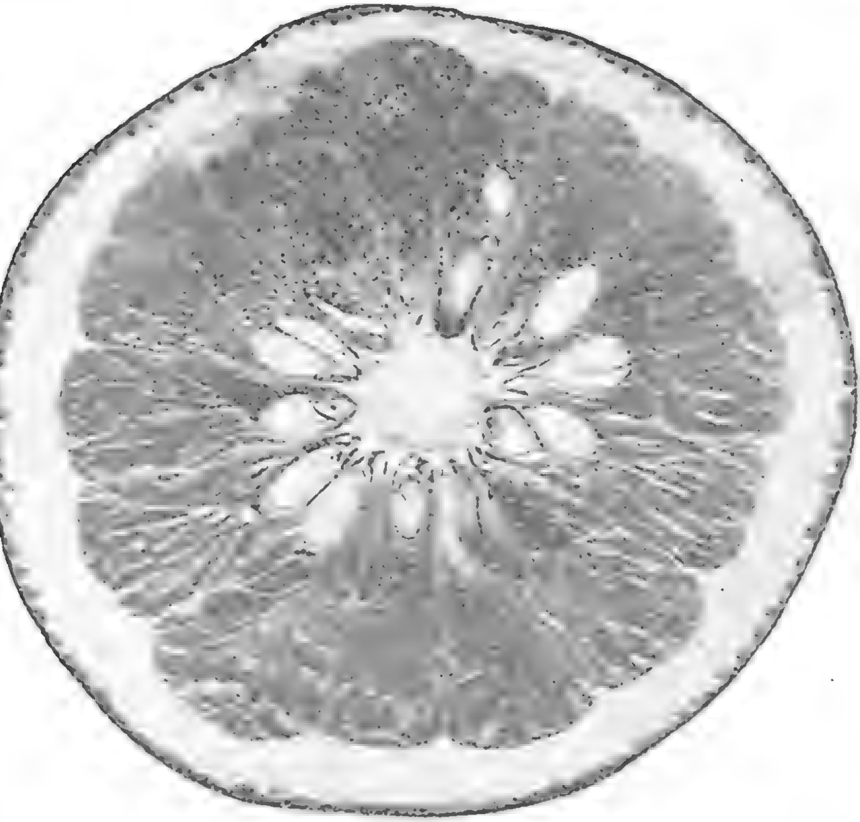


Plate 73.

Cross-section—Duncan Grapefruit.

In preparing for the table, bisect the fruit transversely, using a sharp thin-bladed, slightly pointed knife. Secondly, cut round and remove the core, which operation at the same time removes practically all the seeds. Thirdly, from the centre cut outwards down through the partitions which divide the sections. Finally, cut round the partition enclosing the sections and separating the pulp from the rind. Each half of the fruit may then be lightly sprinkled with sugar to taste and placed in the ice chest overnight. Prepared in this manner, the pulp may be readily scooped out and eaten with a spoon.

TO FIREPROOF CANVAS.

The following directions are given in *Successful Farming* (Iowa) for fireproofing canvas, curtains, or similar material:—Mix 1 lb. of ammonium phosphate and 2 lb. of ammonium chloride in 6 quarts of water, and then soak in it the article it is desired to render fireproof. Lightly squeeze out the excess liquid and let the material dry with the ammonium salts in it.

For the more delicate fabrics use 10 oz. of borax and 8 oz. of boric acid dissolved in a gallon of water. Wring very lightly and allow to dry, but do not rinse the material.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

WINTER marketing conditions are still with us. The month has had, generally speaking, more dull days than usual. This on two occasions caused a sharp decline in fruit values, fortunately only of a temporary nature. The most disappointing feature of the market during the winter has been the poor prices realised for tomatoes. Much of this trouble has been caused through green and poorly matured fruit. The sooner growers realise that artificial colouring methods, to benefit the industry must be used correctly, the sooner will improved prices result. Tests have shown on every occasion the absolute necessity of harvesting none but properly matured fruit. Immature fruit will not colour satisfactorily under any process at present known.

Tests are being conducted by the Department, and progress results should be available by the time these notes are in print. Complaints of green papaws and pineapples are still being received from Southern markets. Following last month's warning the seriousness of this practice is again stressed. The following is a summary of market prices during the latter part of July:—

TROPICAL FRUITS.

Bananas.

Melbourne.—Nines and eights, 23s. to 25s.; sevens, 22s. to 23s.; sixes, 19s. to 21s. Thin, immature lines considerably lower in price, and hard of sale.

Sydney.—Nines and eights, 21s. to 25s. tropical case; sevens, 18s. to 22s.; sixes, 16s. to 19s. Inferior grades considerably lower.

Brisbane.—Nines, 19s. to 22s.; eights, 18s. to 21s. 6d.; sevens, 15s. 6d. to 20s.; sixes, 14s. to 18s. 6d.; smalls, 11s. to 15s.

Lady Fingers, 2d. to 7½d. per dozen.

Pineapples.

Sydney.—Smooths, 7s. to 10s. per case.

Melbourne.—Smooths, 8s. to 10s. Special lines at higher rates. Green fruit hard of sale. Black heart is prevalent.

Brisbane.—Smooths, 4s. 6d. to 7s. case. Loose, 1s. 6d. to 5s. per dozen. Ripleys, 3s. to 5s. case. Loose, 1s. to 3s. 6d. per dozen. Supplies are on the light side and values should be maintained.

Papaws.

Melbourne,—15s. to 18s.

Sydney.—10s. to 14s.

Brisbane.—Yarwuns, 6s. to 9s. per tropical case; Locals, 2s. to 6s. per bushel; Gunalda, 5s. 6d. to 6s.

Complaints of green fruit have been received from all markets. Growers, remember we are in the winter months of marketing!

Custard Apples.

Brisbane.—3s. to 4s. 6d.

Melbourne.—4s. to 6s.

Sydney.—4s. to 6s. 6d.

Some excellent fruit has been on the markets during the season.

Passion Fruit.

Melbourne.—4s. to 7s. per half-bushel.

Sydney.—6s. to 9s.

Brisbane.—Specials to 9s.; firsts, 6s. to 7s. 6d.; seconds, 4s. to 5s. per half bushel.

Avocadoes and Granadillas have not been seen on the market during the month, so no quotes are available.

CITRUS FRUITS.

Mandarins have risen to high levels during the month. Good quality fruit will continue to sell at ruling rates. Oranges had some setbacks due to the dull, wet weather, but as the month closes prices are steady again. Lemons, whilst not returning high values, have remained at a payable level for good lines.

Oranges.

Brisbane.—Navels, 8s. to 10s.; commons, 5s. to 8s.

Sydney.—Navels, 5s. to 9s.; commons, 4s. to 7s.

Melbourne.—Navels, 5s. to 11s.; commons, 3s. to 5s.

Mandarins.

Melbourne.—5s. to 11s.

Sydney.—4s. to 8s.

Brisbane.—Glens, 6s. to 13s.; Special Gayndah, 1s. higher; Emperor, 6s. to 12s.; Scarlet, 5s. to 11s.; Fewtrells, 7s. to 9s.

Grapefruit.

Melbourne.—4s. to 10s.

Sydney.—5s. to 10s.

Brisbane.—5s. to 8s.

Lemons.

Melbourne.—4s. to 9s.

Sydney.—5s. to 8s.

Brisbane.—Gayndah, 6s. to 10s.; locals, 5s. to 7s.; Victorian, 4s. to 7s.

Strawberries.

The dry season has reduced supplies of early berries, but the rains during the last few weeks have caused an increase.

Sydney.—Trays, 3s. to 5s.; boxes, 7s. to 10s. per dozen.

Brisbane.—6s. to 8s. per dozen boxes; choice quality, 9s. to 12s. per dozen boxes.

DECIDUOUS FRUITS.

Apples.

Brisbane Prices.—Jonathan, 6s. to 9s.; Granny Smith, 5s. to 9s., with specials to 10s. per bushel; Sturmer, 5s. to 6s. 6d.; French Crab, 5s. to 6s. 6d.; Democrats, 6s. to 7s.; Rome Beauty, 6s. to 8s.

From now to the end of the season Southern growers should take care to send only carefully selected lines of the larger-sized fruit. Fruit may appear in good condition when it is removed from storage in the South, carry well, and arrive safely on the Brisbane market. The difficulties arise when the Queensland higher temperatures with high humidities are encountered. Again, it must not be forgotten that the country order trade pays the best prices. Fruit bought for this trade often has to travel hundreds of miles before reaching its distributing centre. Growers need have no difficulties if close attention is paid to varieties and sizes. After August only hard, good-carrying types should be sent to Queensland. Rome Beauty, Statesman, Sturmer, and large-sized Jonathan are risky types of fruit to send.

Pears.

Winter Coles, 8s. to 14s.; Josephine, 9s. to 13s.; Broom Park, 6s. to 8s.; Parkhams, 6s. to 9s. The necessity of wrapping all lines of pears is pointed out. Unwrapped lines soon become specky.

OTHER FRUITS AND VEGETABLES.

Cape Gooseberries.

Brisbane.—6d. to 7d. per lb.

Tomatoes.

Brisbane.—Green, 1s. 6d. to 3s.; ripe, 1s. to 2s. 6d.; coloured, 2s. to 4s.

Poor attempts at artificial colouring are the main cause of price discrepancies. Good, full, healthy-looking coloured fruit still maintains the high values. This can only be achieved by using matured fruit for colouring purposes.

Sydney.—2s. 6d. to 4s.; specials, coloured, 5s.

Melbourne.—Queensland, 4s. to 6s.; Western Australian, 7s. to 10s.

Cucumbers.

Sydney.—7s. to 10s. bushel case.

Lettuce.

Brisbane.—1s. to 1s. 6d. per dozen.

Beans.

Brisbane.—9s. to 12s. per bag.

Peas.

Brisbane.—4s. to 6s. per bag.

Pumpkins.

Brisbane.—4s. to 5s. per bag.

Publications.

Booklets on strawberry packing and banana packing are now available on application to the Under Secretary, Department of Agriculture and Stock.

In Memoriam.

WILLIAM REDPATH BENNETT.

Plate 74.

WIDESPREAD regret was felt among his colleagues of the Department of Agriculture and Stock, as well as among large sections of the general public, at the news of the death of Mr. William Redpath Bennett on 30th June.

Mr. Bennett was born at Gateshead-on-Tyne, England, on 3rd May, 1883, and arrived in Queensland in February, 1913. He was appointed an inspector under the Diseases in Plants Act, administered by the Department of Agriculture and Stock, on 1st August, 1916, and, for the greater part of his time in subsequent years, was engaged as a fruit inspector. Although handicapped by deafness, Mr. Bennett at all times was a courteous and capable officer, and his kindly nature gained him the respect and regard of all with whom he came into contact either officially or in his private capacity.

Mr. Bennett's mortal remains were laid to rest at the Lutwyche cemetery on 1st July, after a church service at Windsor, which was attended by the Minister for Agriculture and Stock (the Hon. Frank W. Bulcock), the Under Secretary for Agriculture and the Director of Marketing (Mr. E. Graham), and a representative gathering of officers of the department, fruit merchants, and many others.

To his sorrowing widow and other relatives, deepest sympathy is extended.

Lime-spreading Machinery.*

H. W. KERR.

IT is now well-recognised that most of the alluvial soils of North Queensland, as well as certain areas of other classes of soils in these parts, are in need of regular lime applications to destroy the acidity which develops under conditions of high rainfall, and which acts detrimentally to the growth of the cane crop.

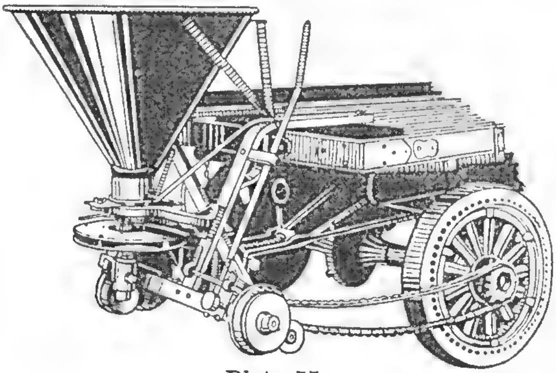


Plate 75.
Broadcaster Mounted on Motor Truck.

With the realisation of this need, attention has also been given to means by which lime may be spread speedily, evenly, and cheaply. This is particularly the case where the use of burnt lime is desired. This material is very disagreeable to handle, owing to its caustic nature, and the double handling which is necessary, where it is dumped in small heaps to slake before spreading, adds to the costs of application. Now that pulverised burnt lime is readily available, the use of a lime spreader becomes possible with any of the several forms of lime.

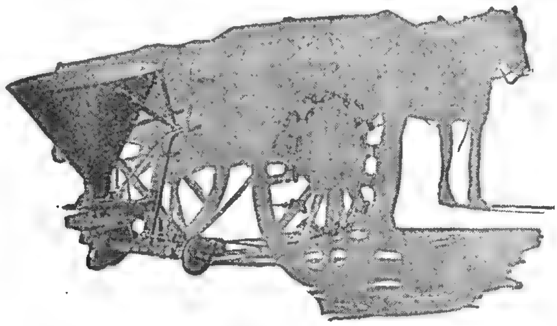


Plate 76.
Broadcaster Mounted on Dray.

The usual form of spreader employed by certain northern growers is the well-known hopper mounted on wheels, and by means of the mechanism which it contains the lime is delivered through small feed drills set in the bottom of the hopper. The amount delivered can usually be adjusted over a fairly wide range.

Another type of lime-spreader, which can be accommodated for use with standard farm vehicles, might appeal to those growers who do not

*From *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations), July, 1937.

feel disposed to purchase a more expensive unit which can be employed for lime spreading only. Several forms of this Australian-made equipment are shown in the accompanying illustrations (plates 73-76). The essentials of the unit may be attached quickly to a dray, wagon, or motor truck. The dumping of the lime on the headland and its transfer to the lime-spreader are thus avoided, as the lime may be spread directly from the vehicle which transports the material from the railway truck.

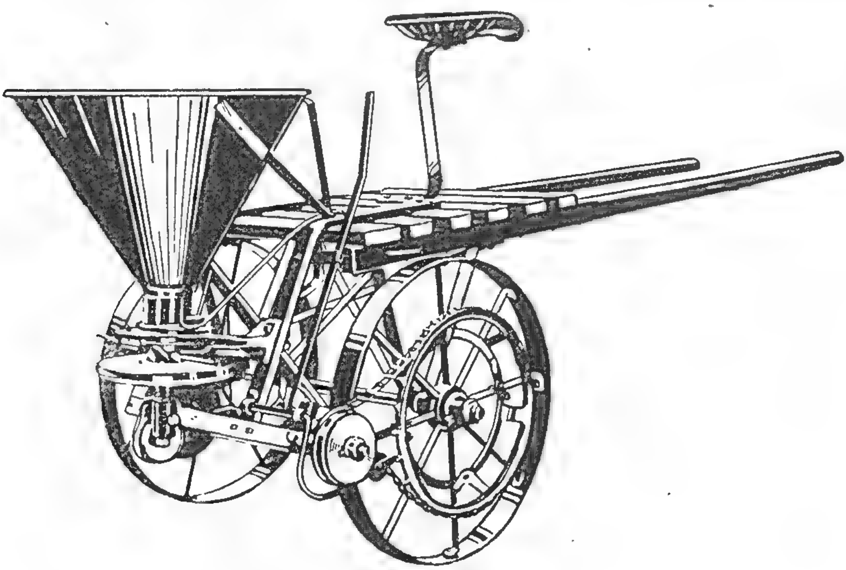


Plate 77.
Broadcaster Mounted on Steel Wheel Sulky.

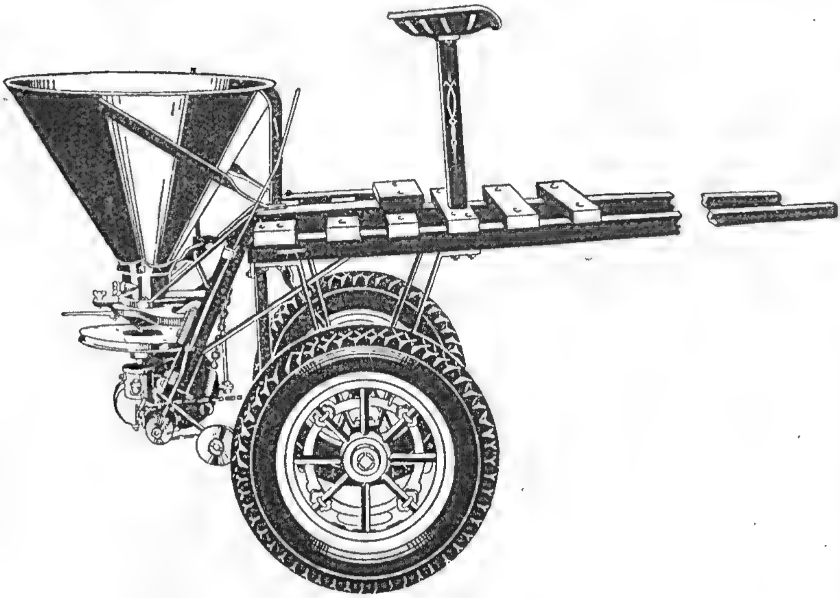


Plate 78.
Broadcaster Mounted on Sulky with Pneumatic Tyres.

It is claimed by the manufacturers that the spreader is of robust construction, and the lime may be spread over a strip 18 to 20 feet wide.

This obviates the necessity for driving close to fences or other obstructions. The range of application varies from less than a hundredweight (when broadcasting superphosphate for example) to a ton or more where this is desired. Areas of up to 250 acres per day have been covered, with a motor lorry attachment, when pastures were top-dressed with superphosphate. The correct size of chain and sprocket is supplied, in these circumstances, for the particular make of truck being used. It is stated that the gears are totally enclosed in an oil bath, so as to eliminate wear from dust and grit. The one serious objection to this type of broadcaster might be the difficulty of spreading very fine lime in windy weather. However, the spreading of normal crushed lime should not present this difficulty, and for fine powdery material the work would be confined to the early morning hours.

The approximate weight of the attachment for wagon, dray, or truck is 3 cwt., while the complete unit on wheels—either steel or pneumatic tyres—is 6 cwt.

Any grower desirous of obtaining further details regarding these machines should communicate with the Director, Bureau of Sugar Experiment Stations, Brisbane, who will put him in touch with the manufacturers.

IN THE CITRUS ORCHARD.

Abnormally dry seasonal conditions have not only resulted in light crops, but have affected tree growth adversely. Every endeavour therefore should be made to effect an early cleaning up of orchards and to afford the trees an opportunity to put out healthy, vigorous growth and blossom in the spring.

In the younger orchards, where well-developed frameworks have been maintained, the usual pruning, such as the removal of suckers and decadent first-fruiting shoots, should be carried out.

In the older orchards, the lack of vigorous healthy fruiting wood has become more pronounced. This condition points to the necessity for a rather severe thinning-out, and, at the same time, a shortening back of terminal growth and twigs. The cuts should be made right back to strong growths; weak shoots and those that have borne fruit should be removed. The thinning leaves spaces for subdivision, while the shortening back tends to force into growth dormant buds from behind. At the same time, it stops an excessive growth of branches and renews supplies of fruiting wood. In cases in which crowding is evident, the removal of entire branches is desirable. The entry of plenty of light and air assists the growth of healthy and vigorous shoots which make new fruiting wood. Any excessive growth of suckers or water shoots arising well inside the tree as a result of heavy pruning needs to be cut away, or it will crowd the centre of the tree.

In older trees, where vitality has been impaired, provision will need to be made for the removal of old, crowded, and decadent limbs. In such instances the pruning is much heavier than usual, necessitating the removal of entire branches. Such branches should be cut right back to their source of origin, so that the sap will be readily diverted to the remaining limbs and encourage the formation of new fruiting wood. Under no circumstances whatever should stubbing be resorted to. In instances where it is necessary to replace larger limbs, the work should be done gradually over two or more years in order to avoid excessive suckering.

Lower branches of trees should not be allowed to touch the ground, as fruit borne on such branches is generally blemished and of poor quality. On the other hand, trees should not be pruned too high from the ground. The height to which they should be lifted varies according to circumstances, but in most instances knee-height will be satisfactory.

R. L. Prest.

Rat Investigation.*

W. A. McDOUGALL.

AT this conference last year a progress report on rat investigations was presented. Actually that report, compiled after a short time in the field and on the advice and writings of men eminent and experienced in this line of work, set out in a general way the proposed method of attacking our rat problem. During the past year no good reasons have come to our notice (either from the results of the work of others or from our own experiments) which warrant materially altering the original programme. It has been persevered with and advanced as far as possible under somewhat adverse conditions. References to the chief of these conditions, i.e., the abatement of the epidemic of 1934-35, will be made here and there in this report and they will partially cover several of the points mentioned or inferred in last year's report.

During June-September last year a brief survey of mill areas north of Townsville (Mourilyan and Goondi partially excepted), the Burdekin, and the Central Districts, showed the house rat, the field rat, and the khaki, tree, or "Melomys" rat to be present in all of them. However, all these mill areas with one exception (the Central Districts), and irrespective of whether systematic or sporadic poisoning campaigns had been carried out, suffered comparatively light rat damage last year. In these circumstances it is not possible to state definitely the rat or rats responsible for the severe damage during past epidemics in all the districts mentioned above, but field observations and cage experiments indicate that the field rat is by far the most important. So far this rat, without variations, has been found to exist only along the coast from Mackay to some miles north of Mossman. Within this area its full distribution is not known. Past damage to cane tends to connect it, at least superficially, with coastal rivers and creeks. It is also present in the higher and well-grassed portions of marine swamps, and in some districts it damages cane high up on hill sides and against "scrub." In some districts against scrub is the chief locality of damage. So far as is known the common scrub rat of the coastal districts (*Rattus assimilis* and its varieties which extend throughout Eastern Australia) does not eat cane and the field rat does not enter scrub. To date most of the heavy damage in cane against scrub in the Central Districts shows both the field and khaki rats to be present. The khaki rat has a comparatively wide distribution, and the conditions under which it exists vary considerably.

In the furtherance of the subject of rat distribution and as an indication of the lines along which our efforts at control are directed there is a fundamental idea which could be expressed at this juncture. This idea or fact is very well put in the writings of a man who is probably one of the most eminent and experienced authorities on ecology and rodent plagues, as follows†:—

> "it is a familiar fact that serious plagues of mice, rats, and other rodents occur from time to time in various parts of the world, often causing a great deal of damage. Readers of Mr. Elton's book will discover that these violent outbreaks are but special cases of a regular phenomenon of periodicity in numbers

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* Address to the Pests Boards Conference, held at Meringa, 13th May, 1937, and reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations), July, 1937.

† From the Editor's Introduction by Julian S. Huxley to "Animal Ecology" by Charles Elton, 1935.

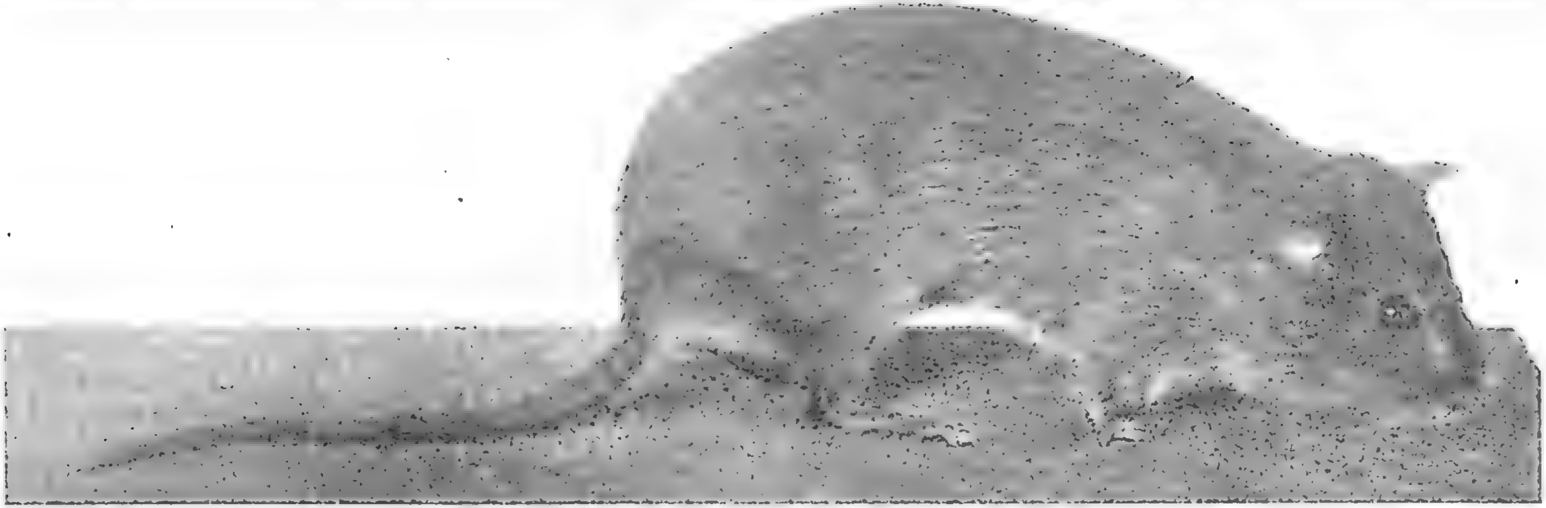
which is perfectly normal for many of the smaller mammals. The animals favoured by climatic conditions embark on reproduction above the mean, outrun the constable of their enemies, become extremely abundant, are attacked by an epidemic, and suddenly become reduced again to numbers far below the mean. When such a number-maximum is so accentuated as to become a plague remedial measures are called for locally, and large sums of money may be spent. Eventually the normal epidemic breaks out and the plague abates. The organisers of the anti-rodent campaign claim the disappearance of the pest as a victory for their methods. In reality, however, it appears that this disappearance is always due to natural causes, namely, the outbreak of some epidemic; and the killing of the animals by man has either had no effect upon the natural course of events, or has delayed the crisis with the inevitable effect of maintaining the plague for a longer period than would otherwise have been the case. In the latter event, it would actually have been a better counter measure to do nothing at all than to spend time and money in fruitless killing. If remedial measures are to be desired, they should be of some special sort. Either they must encourage the development of the epidemic, as by introducing infection amongst the wild population of the pest species; or they may aim at reducing reproduction . . . . ; or they must be aimed at the general ecological status of the species, making it more difficult for it to live and reproduce . . . .''

It cannot be expected, nor would it be wise, if those of us who have to conduct campaigns with the often tried and varied conventional methods at our command were convinced of the truth of the above inference, that the methods should be dropped and nothing done. On the other hand, it should not be expected that a research officer will dodge an unpleasant and unpopular fact and go along the well-beaten track thereby deluding himself and others, when there may be possibilities in other directions. This more or less explains our interest in rat distribution, rat behaviour, populations, and breeding under different conditions. During the past year some preliminary work on these subjects has been done. None of it, as yet, is conclusive. Also it is too early to report on the sick rats (and dead ones found above ground) which have been taken in the Central District (no baits present) since October last.

Whilst always bearing in mind that plague conditions and light sporadic infestations might well be treated separately, some poison experiments have been carried out, some attempts at population estimates have been made, and a preliminary investigation of deterrent sprays has been commenced. The results of all these experiments were unsatisfactory—in fact they may be placed, with a large percentage of all rodent work, under the heading of experience and not scientific experimentation.

For the possible use of field men the minimum lethal doses of all the common oral rat poisons, combinations of them and some others should be completed by the end of this year.

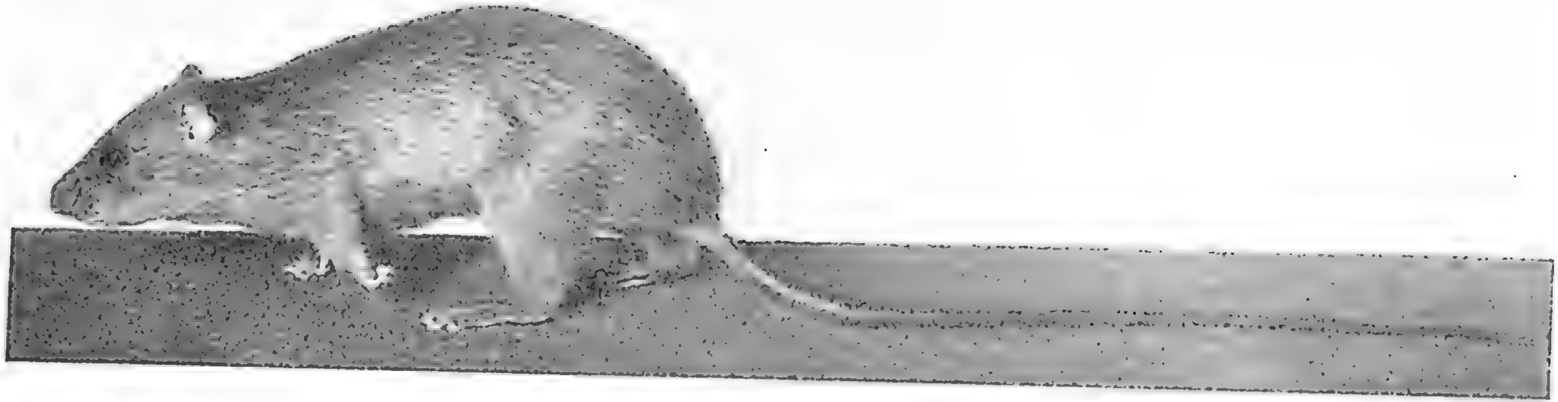
As this report has been written primarily for the purpose of opening discussion on the subject of rat control no detail has been given and it may be concluded with paragraphs on varieties and rat control work being done in other countries.



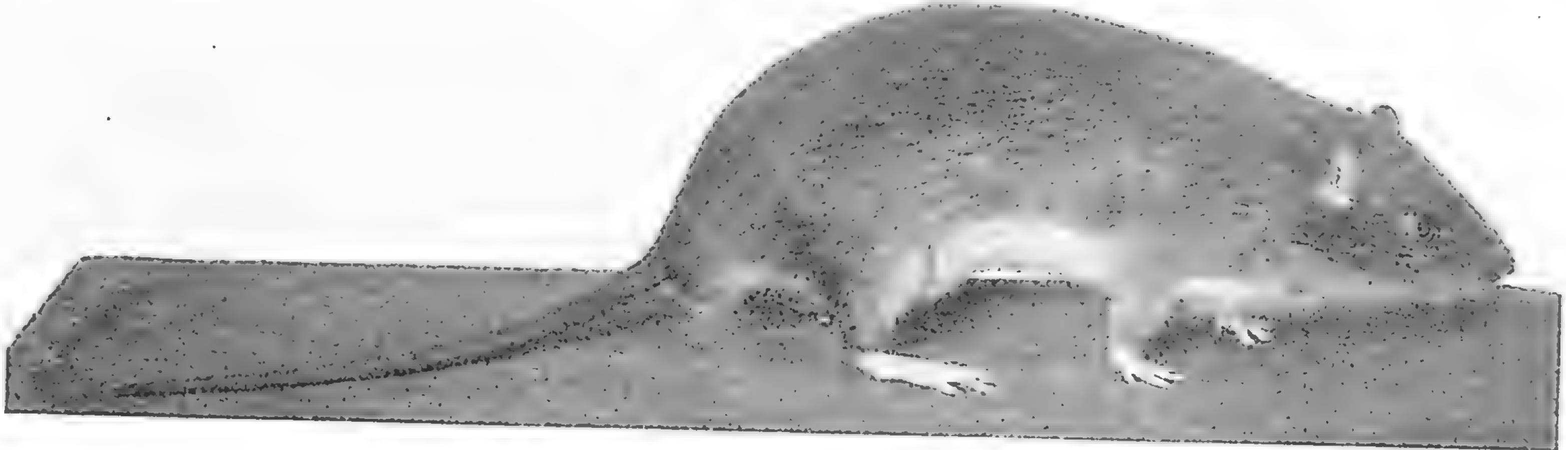
a. Rattus culmorum or the Field Rat ($\frac{3}{4}$ natural size).

b. Melomys littoralis or the Khaki Rat ($\frac{4}{5}$ natural size).

PLATE 79.—The Feld rat and the Khaki rat, the two species chiefly responsible for damage to cane in Queensland canefields.



a. Rattus rattus or the House Rat (½ natural size).



b. Rattus norvegicus, the Brown or Sewer Rat (½ natural size).

PLATE 80.—The House rat and the Ship rat are chiefly responsible for damage around stables and farm houses and in towns. The House rat occasionally damages cane but is not a serious pest in the canefields. The Brown rat, although present in some sugar towns, has not been found in Queensland canefields.

It has been found that any variety of cane may, at times, be severely damaged by rats. The extent of damage depends, amongst other factors, upon rat population, the conditions under which the rats are present in the cane, and the ability of the variety to stand up to rat attack. For example: in rat country in Central Queensland P.O.J. 213 is a badly-damaged variety. It provides excellent cover, its thin barrel will not stand up to many "feeds," and it is soft. Badila, Co. 290, P.O.J. 2725, and Clark's Seedling all provide rat food which is readily accepted by the pests. Fields of P.O.J. 2714 and E.K. 28 where misses were planted up with Clark's Seedling have been inspected. Nearly every such stool was found to be badly rat eaten whilst the others were left alone. Farms where flooding is not experienced and where fields of Badila and P.O.J. 2878 are grown have shown the former to be severely rat damaged and the latter to be comparatively free of bites. On the other hand, P.O.J. 2714, E.K. 28, and P.O.J. 2878, grown on the higher patches of marine swamp, have suffered severe damage Standover crops of these varieties are often attacked by rats, as are D. 1135 and Uba either as ratoons, plant, or standover cane.

As may be known to many of us, at the present time an extensive rat control research programme is under way in the Hawaiian Islands. No doubt in the near future, particularly if another plague soon comes along, we in this country may hear more of hambergers, and rolled oats, &c., as bases for baits. An attempt is also to be made there to learn something of the life history, &c., of the rat with which they are dealing. A comparison of this work with our own along similar lines should be interesting and useful. In several other countries attempted control of the house rat by new materials is in progress. Although not applicable to our field conditions the use of fumigation by "smoke" in parts of India could be noted.

PREPARING LAND FOR SPRING PLANTING OF PINEAPPLES.

The early preparation of land for the spring planting of pineapples is desirable, and areas to be planted should be ploughed now, as deeply as the implements available and the depth of the surface soil will permit. If possible, this ploughing should be followed by at least one subsoiling to a depth of 18 inches. On no account should the subsoil be brought to the surface. The land should be left in the rough for some time, and, later, ploughed and cultivated to a good even tilth. It will then be in good condition for planting at a favourable opportunity in the spring. It should be borne in mind that a stand of pineapples remains in the ground for several years, and consequently deep cultivation must be carried out prior to planting.

Adequate preparation, as suggested, improves both the aeration and moisture-holding capacity of the soil and thus enables root growth to take place under the most favourable conditions. This is most important, since the first few months of the life of a pineapple plantation largely determine its productivity. Furthermore, as has been demonstrated convincingly, vigorously growing plants are highly resistant to disease.

W. G. Hancock.

Branding and Earmarking of Stock.

H. S. ILIFF, Deputy Registrar of Brands.

THE following particulars regarding the branding of stock and the earmarking of cattle and sheep may be of interest to stockowners who are not clear as to the requirements of the Brands Acts and Regulations:—

The branding or earmarking of stock is not compulsory in Queensland; but, if either is used, only brands and earmarks registered under the Brands Acts will be permitted.

Registered brands or earmarks are not necessary in the case of tattoo brands, pig brands, paint brands on cattle or horses (for temporary identification purposes), age numerals, or stud and herd book numbers imprinted below a registered brand at the first branding.

A brand may be used without an earmark, but an earmark may be used only on cattle carrying the owner's brand with which the earmark is registered.

In earmarking, the marks must be made on the portions of the ear or ears indicated in the registration certificate. The use of a knife for earmarking is illegal.

BRANDING.

Horse and cattle brands may be used in any part of Queensland, but earmarks are issued for use in specified districts and may be used only in the district for which the earmark is registered. Only the full brand can be used, and the owner may imprint the first brand on his cattle upon any one of the following positions:—

First position—neck.

Second position—rump, hip, or thigh.

Third position—ribs.

Fourth position—shoulder or top of arm.

The first brand on a horse may be put on any one of the following positions:—

First position—"near shoulder."

Second position—"off shoulder."

Third position—"near quarter" or "near thigh."

Fourth position—"off quarter" or "off thigh."

Fifth position—"near ribs."

Sixth position—"off ribs."

(The "off" side is the right-hand side and the "near" side is the left-hand side in all stock.)

The owner of a symbol horse and cattle brand may use the symbol brand either in addition to or instead of the three-piece brand with which the symbol is registered.

In the case of first brandings, the symbol brand may be imprinted upon either cheek of stock, but any second or subsequent branding must, if there is sufficient space, be placed at a distance of not less than 1½ inches nor more than 2½ inches from, and directly underneath, the

previous brand imprinted on the stock. If there is insufficient space underneath the previous brand, rebranding must be done on the next position. If, for instance, the previous brand is on the fourth position in the case of cattle, or on the sixth position in the case of horses, and there is not sufficient room for a new brand on those positions, the rebranding must be done on the first position—the neck in the case of cattle, and the near shoulder in the case of horses.

It is important to note that when a second or any subsequent brand is imprinted on cattle, it must be placed on the same side of the beast as the immediately preceding brand. The branding of cattle is thus confined to one side.

(Symbol brand owners may have a special position allotted upon which to rebrand purchased horses and cattle.)

The penalty for a breach of these rules of branding is £50.

In the case of first brandings, an owner is entitled to select any one of the positions here specified.

The size of branding irons is restricted to not less than $1\frac{1}{4}$ inches in length or more than $3\frac{1}{2}$ inches in length for horses and cattle.

Fully grown stock may be branded with a brand not less than $1\frac{1}{4}$ inches in length or more than 5 inches in length.

EARMARKING.

It is illegal to earmark cattle which have been previously earmarked, or to put any unregistered mark or cut of any kind upon the ears of cattle.

Purchased stock with two full ears may be earmarked provided they are first rebranded with the owner's brand with which the earmark is registered.

Earmarking for distinctive purposes, such as to denote speying, inoculation, &c., is illegal.

The dewlap mark may be used for any distinctive purpose, but it is not registered or recognised by the Department.

Distinctive brands, for use on the cheek of cattle or horses, may be registered without fee, to denote age, class, inoculation, speying, &c. These cheek brands may be used only on stock bearing the owner's registered three-piece brand.

The breeder or first brander may imprint numerals under his registered brand for stud or herd book reference or to denote the age of his horses or cattle.

The removal of more than one-third of the ear of any stock in earmarking is illegal.

SHEEP BRANDS AND MARKS.

Sheep earmarks may be used without a sheep paint brand or fire brand, or *vice versa*. All registered sheep earmarks must be made on the "near ear" of female sheep, goats, or swine, and on the "off ear" of male animals.

When sheep have been earmarked with a registered mark, it is illegal to earmark them again on the "registered ear." Distinctive marks to denote the age, class, &c., must be imprinted on the "off ear" of female animals and on the "near ear" of males.

These marks are not registered, but no distinctive marks may be used which are similar to any registered earmark used in the same locality.

Earmarks, paint brands, and fire brands must be used on the positions for which they are registered and as shown on the certificate of registration.

As in the case of cattle earmarks, the use of a knife for earmarking sheep is illegal, and pliers must be used. There are no exceptions to this rule.

In the event of the death of the owner of any brand or earmark, it is necessary to have a transfer of the brand or mark into the name of the person who wishes to make use of them. All owners of brands or earmarks should notify the Department of any change of address.

The alteration of address is published in the next issue of the *Government Gazette,* and is a protection to the owner in the event of any of his stock straying or being impounded.

The fees for the registration and transfer of brands and earmarks are as follows:—

	£	s.	d.
Registration of a horse and cattle brand ..	1	0	0
Registration of a horse and cattle symbol brand	7	10	0
Re-registration of a cancelled horse and cattle brand	3	0	0
Registration of a cattle earmark	1	0	0
Transfer of a horse and cattle brand		10	0
SHEEP BRANDS AND MARKS.			
Registration of a sheep paint or fire brand ..		5	0
Registration of a sheep symbol brand ..	3	0	0
Registration of a sheep earmark		10	0
Transfer of a sheep brand and earmark ..		5	0

SEED POTATO SELECTION.

The problem of obtaining suitable seed potatoes for the early crop confronts most growers every year. This seed must necessarily come from southern sources, and, although the regulations demand that the bags must clearly bear the name of the variety, attention is called to the risk of buying seed of inferior quality. On most farms, it is a common practice to grade out all undersized tubers and sell them as seed. This means that the weakest and least prolific strains of the variety are included and the risk of a poor return is obvious. Much can be said in favour of purchasing larger potatoes and cutting them into sets, as this largely eliminates the danger of rubbish being planted.

It is false economy to cut the sets too small, as they serve as a reserve food supply for the plant during the early stages of its growth. Small sets soon become exhausted and the growing plant fails to receive the necessary assistance. This check hinders normal growth and handicaps the plants in the formation of tubers. Sets should not be allowed to dry out more than can be helped before planting.

For the late crop, round seed is recommended and most growers manage to reserve their own requirements. The practice of selecting this seed at the time of harvesting from the most prolific plants is well worth the extra trouble.

A. F. Skinner.

The Present Situation Regarding the Giant American Toad in Queensland.*

R. W. MUNGOMERY.

DELEGATES will no doubt remember that during the last conference we were labouring under a ban, imposed by the Federal Government, which restricted the distribution of toads to the Cairns, Gordonvale, Innisfail, and Tully districts. While this ban gave us the opportunity to stock up those districts in great detail, it affected rather harshly those districts where grub damage was not sufficiently widespread and serious to warrant the first toad liberations being made there, but where, nevertheless, grubs were serious in localised areas. Growers in these areas subsequently found themselves in the position of desiring a liberation of toads, while it was impossible to liberate any in their areas by virtue of the existence of this ban.

Accordingly we took this matter up further with the Federal Health Department who are responsible for the administration of the quarantine laws. After analysing the excreta of toads collected in this district under a variety of conditions, and dissecting a number of toads caught similarly, we presented to the Health Department the details of what they had eaten, with the result that the ban was finally lifted in September of last year. Since then toads have been liberated in the Mossman, Babinda, Ingham, Bambaroo, Giru, Ayr, Mackay, Bundaberg, and Isis districts.

It is pleasing to note that the first Australian-bred generation have commenced breeding, and toadlets are now plentiful in areas where the toads were originally liberated. Egg strings can occasionally be found in the pools along the Little Mulgrave, whilst the same pools harbour thousands of tadpoles. Breeding has been taking place there continuously since last December. Records of breeding have come from other places in the Mulgrave, Hambledon, and Innisfail districts, and toad populations in these places will soon take a sudden rise. We have, therefore, discontinued liberations in these districts ever since toads from the first liberations became mature, as any further liberations at this juncture would not add appreciably to the already existing populations there. We plan to continue extensive liberations in the central and southern districts for some time, so that having once established big populations in those areas there should be no need to make further liberations there next year.

With regard to the usefulness of toads against the Greyback beetle pest, it is much too early to judge their efficacy yet. Certainly they could have had very little or no influence on the beetle pest last year because during the flighting period the number of mature toads at large which would be capable of eating a Greyback beetle would then be too small. However, it is possible that during the coming year, in localised areas, we may gain some idea of their possible effects. I refer particularly to the Little Mulgrave area where toad populations are now dense, and grubs are now commencing to reassert themselves, and where if no serious check occurs beetle emergence is likely to be intensified at the end of this present year.

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* Presented to the Pests Boards Conference held at Meringa, 13th May, 1937, and reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations), July, 1937.

The Treatment of Horses for Worms.

AT a recent mass meeting of canegrowers held in Nambour, a very interesting address was delivered by Dr. F. H. S. Roberts on the treatment of common ailments of the farm horse. At the request of Mr. W. Kittle, Secretary of the Moreton District Canegrowers' Executive, the following notes were prepared by Dr. Roberts, for the guidance of canegrowers generally:—

Tapeworms.—Starve for 24 hours, then give 2 fluid oz. of turpentine and 1 dram male fern extract in 2 pints of raw linseed oil. Food and water may be given 4 hours after treatment. These dosages are for an animal weighing 1,000 lb. or more and should be reduced for lighter animals.

Stomach Worms.—Starve for 24 hours, then give 2 quarts of a 2 per cent. solution of sodium bicarbonate (baking soda). Thirty minutes after giving this solution, give carbon bisulphide at the rate of 2½ cubic centimetres for every 100 lb. of weight. Food and water may be allowed 4 hours after treatment. The carbon bisulphide is given enclosed in a gelatine capsule as a ball.

Bots and Large Roundworm.—Starve for 24 hours before and for 4 hours after treatment. Give carbon bisulphide at the rate of 2½ cubic centimetres for every 100 lb. of weight in a capsule as a ball. For the large roundworm, the horse may receive, instead of carbon bisulphide, oil of turpentine at the rate of 5½ cubic centimetres for every 100 lb. of weight. The turpentine is mixed with raw linseed oil (1-2 pints according to weight) and given by means of a bottle.

Strongyles or Palisade Worms.—If possible, starve up to 36 hours before and for 4 hours after treatment. Give oil of chenopodium mixed with raw linseed oil. The chenopodium is given at the rate of 1½ cubic centimetres for every 100 lb. of weight. Make sure the linseed oil moves the bowels; if not, give more oil. The chenopodium and linseed oil may be mixed and given with a bottle.

Pin Worms.—Wash out the rectum with an enema of 1-2 gallons of lukewarm water containing 2-4 oz. of sodium bicarbonate. Starve for 36 hours and then give oil of chenopodium as for Palisade Worms.

—*The Cane Growers' Quarterly Bulletin.*

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of June, 1937 (273 days unless otherwise stated).

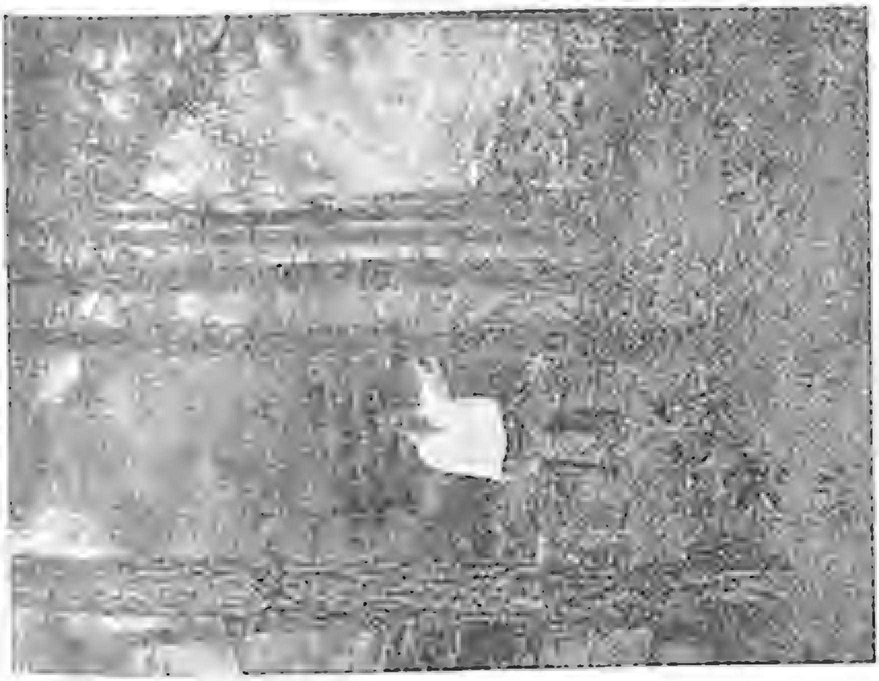
Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS			
	MATURE (OVER 5 YEARS), STANDARD 350 LB.			
Model 3rd of Alfa Vale	W. H. Thompson, Nanango	15,782·05	684·399	Reward of Fairfield
	SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.			
College Gold II.	Queensland Agricultural High School and College, Lawes	11,104·45	466·506	Premier of Hillview
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
College Stately 4th (365 days)	Queensland Agricultural High School and College, Lawes	12,451·54	493·915	College Robin
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Laguna Fussy	F. G. Lamkin, Moola, Dalby	6,964·3	294·598	Morden Marcus
Trevor Hill Twinkle	Geo. Gwynne, Umbiram	7,274·31	263·104	North Glen Emblem
Trevor Hill Nectar	Geo. Gwynne, Umbiram	6,754·44	254·545	North Glen Emblem
	JERSEY.			
	MATURE (OVER 5 YEARS), STANDARD 350 LB.			
Trecarne Rosella 4th	T. A. Petherick, Lockyer	7,410·27	353·362	Trinity Officer
	SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.			
Glenmore Bluebell	L. J Comiskey, Warra	5,212·51	289·131	Glenmoore Jolly Jester
	JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.			
Kathleigh Glory	J. Goostrey, Landsborough	6,037·45	314·749	Retford Royal Atavist
Maurfield Larkspur's Dewdrop	F. Maurer, Darra	4,993·55	280·648	Prospect Monto
Lorine of Calton	D. R. Hutton, Bellgarth, Cunningham	5,235	270·952	Retfords Glory King II.

Forestry in Queensland.

[*Photo: J. A. Lunn, Survey Office.*

Plate 81.

A Thinned-out Cypress Pine Stand near Barakula.—Natural regeneration and thinning operations by the Field Staff of the Queensland Forest Service have greatly increased the growth and improved the stand in our hardwood and cypress pine forests.



[Photos: *Queensland Forest Service.*

Plate 83.

Slash Pine Plantation at Barron.

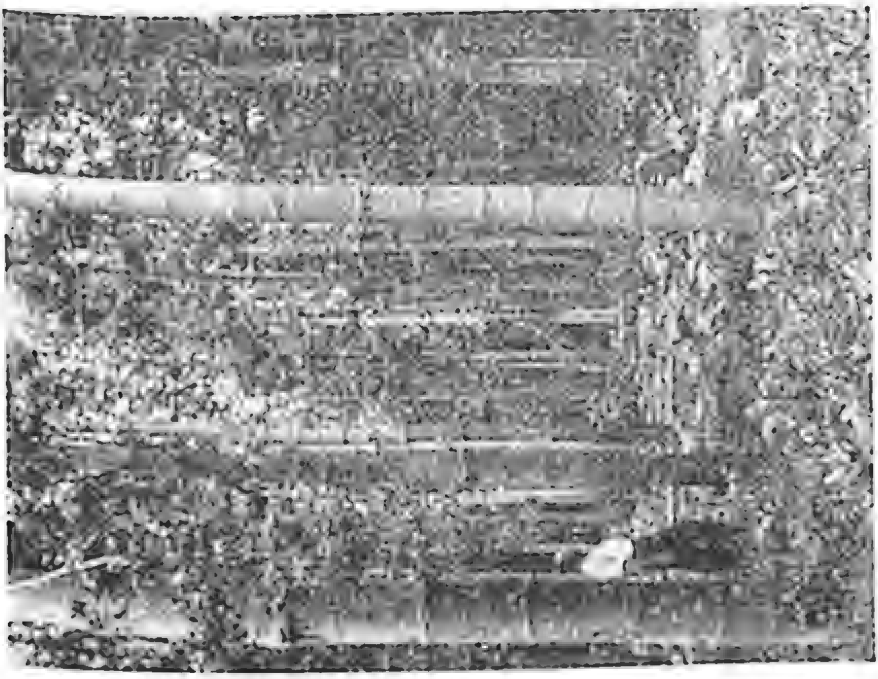


Plate 82.

A Twenty-year-old Stand of Kauri Pine at Barron, North Queensland.

Plate 84.

A PLANTATION OF RED CEDAR AT BARRON.

[Photos.: Queensland Forest Service.

Plate 85.

A SEVEN-YEAR-OLD MAPLE PLANTATION AT GADGARRA, NORTH QUEENSLAND.

Hoop pine is most used by the Queensland Forest Service in its plantation work, but other valuable indigenous softwoods and cabinet-woods are also included in forestry operations.

[*Photo: Queensland Forest Service.*

Plate 86.

A 10-Year-old Silky Oak Stand at Colinton, Brisbane Valley.—The total area of forest plantations in Queensland is now about 20,000 acres. Every year the acreage is increased. State forest reserves, which already cover an immense area in the aggregate, are being extended also in every timber region in which the conditions and requirements of land settlement permit.

[*Photo: "Telegraph" Newspaper Company Limited.*

Plate 87.

NATURAL REGENERATION IN A BLACKBUTT FOREST.—The thinning was done by a party of youths working under the Juvenile Employment Scheme instituted by the Queensland Government.

Plate 88.

Snigging Hardwood Logs with a Caterpillar Tractor, Mapleton State Forest.—Over 22 million super feet of hardwood logs are sold annually from Crown forests. In 1935-36 sales of all kinds of timber from State forests aggregated 148 million super feet.

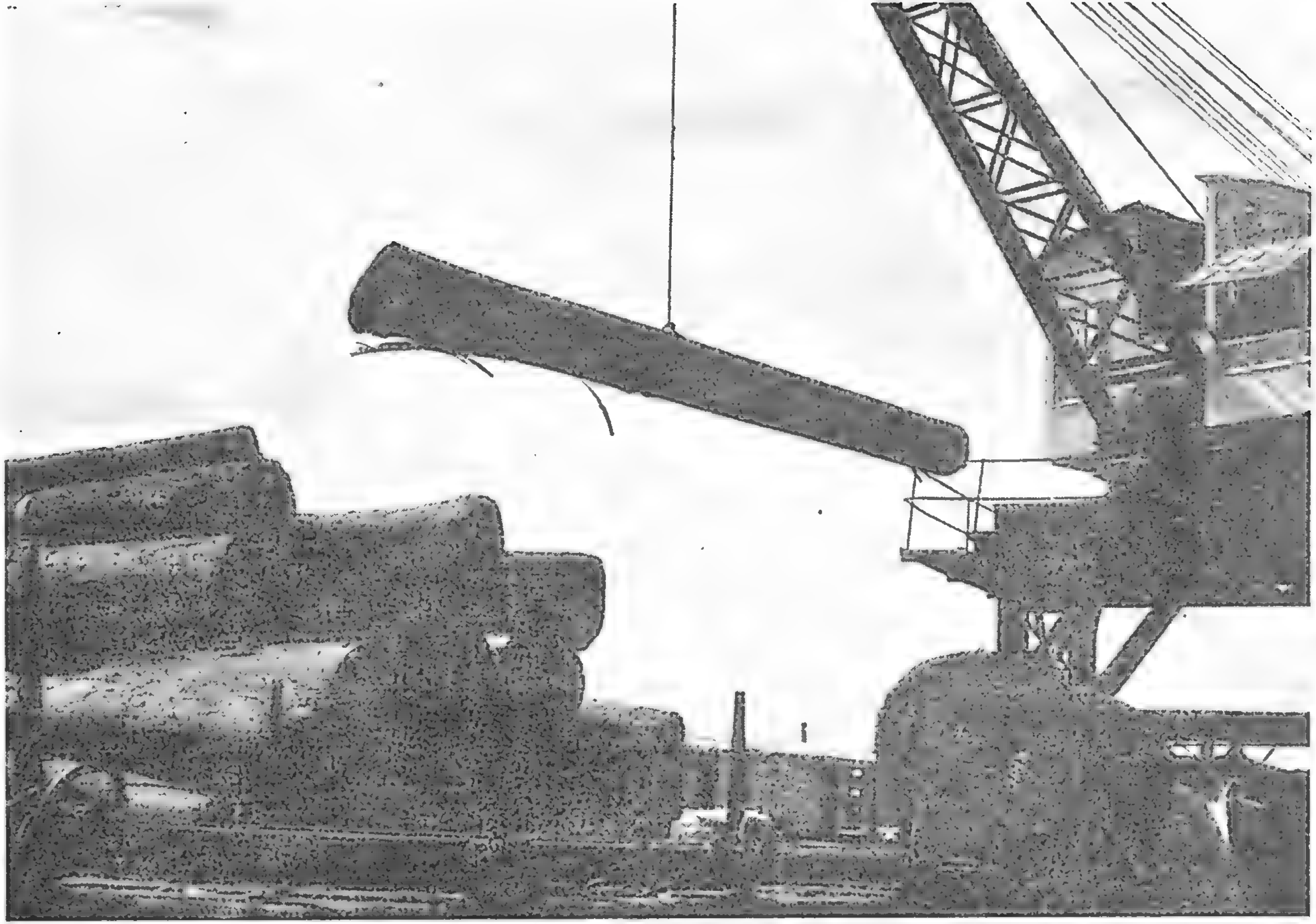


Plate 89. [Photo: "Telegraph" Newspaper Coy. Ltd.

WEALTH FROM QUEENSLAND'S TROPICAL TIMBER LANDS.—Stacking Walnut and Silky Oak logs for shipment at the harbour side at Cairns. An electric crane pro vides the lifting power.

Plate 90.

Logs from the Rain Forests, Atherton Tableland.—Rafts of Kauri Pine awaiting shipment, Cairns Harbour.

The Tropics and Man

Circulation of the Blood.

DOUGLAS H. K. LEE, M.Sc., M.B., D.T.M., Professor of Physiology, University of Queensland.

Second Series: No. 1.

In the sixteenth century, when the now famous William Harvey proved conclusively that the blood goes round and round the body, time after time, repeating its work over and over again, he was not believed. To-day, every schoolboy knows the way the heart works. If he is a very bright schoolboy, he will probably remember that the left side of the heart pumps bright red blood, full of oxygen, into the arteries; that these arteries take the blood to all parts of the body; that the veins bring darker blood, poor in oxygen, back again to the right side of the heart; and that the right side of the heart pumps it through the lungs, where it takes up oxygen, becomes bright red again, and sends it back to the left side of the heart to commence its trip all over again.

This bright schoolboy will also be able to remember that, not only does the blood pick up oxygen on its trip through the lungs and give it up to the tissues all over the body, but that it also picks up waste matter from these body tissues and takes it away to such organs as the lungs, kidneys, and liver, where these waste materials are taken out and thrown away. Furthermore, pleased at showing off his knowledge, he will describe how food substances are picked up by the blood from the intestines and taken to the tissues which need them, and to store-houses when they are not wanted immediately.

The Work of the Blood.

From the information given us by this bright schoolboy we could lay down some of the important jobs that the blood and the machinery, which sends it round, have to do. Firstly, it has to supply oxygen to all parts of the body; secondly, it has to take waste substances away from all parts; thirdly, it has to supply food to all parts. There are other jobs to be done also, which, although much more subtle and beyond the schoolboy's interest, are equally important. The total amount of certain substances (salts) dissolved in the blood must be just right, not too much of one, or too little of the other. The amounts of acid substances and the amounts of alkaline substances must balance very accurately, so that there is a shade more alkali than acid present. Its temperature must be within certain limits. There must be a certain amount of those substances the chemist calls colloids present and so on.

You see how extraordinarily important and delicate a matter this circulation of the blood is. If it is not pumped to the tissues fast enough, or if it does not contain enough oxygen or food, or if something is wrong with the mixture, then the tissues concerned can no longer work. When, for instance, we do unaccustomed work, our muscles quickly get tired and even painful. The blood supply is not good enough to supply oxygen and remove wastes at the rate required by the active muscles, and they quickly go on strike.

Importance of Circulation in Heat.

You are probably asking why I have spent all this time talking about the blood and what it does, and have said nothing about the tropics, which is what you want to know about. Now there are three systems in the body that are most susceptible to exposure to heat—the nervous system, the ductless glands, and the blood circulation. Moreover, the first two depend a very great deal for their proper working upon the circulation of the blood. If we do not understand how and why the blood circulates, we shall be like the old-time car-owner's wife, who suggested to her begrimed and exasperated husband that he should look and see if the carburettor were short-circuited.

Partial or complete failure of the circulatory system is the commonest cause of chronic or acute distress from exposure to heat. As we might expect, the nervous system is by far the most delicate system in the body, and has the greatest opportunity for making its distress evident. This is a most fortunate circumstance, in that warning signals are displayed at a very early stage. These are usually heeded. Lassitude, dull headache, inability to concentrate are well-known effects of hot days. If they are ignored, attention is usually forced to them, even if fainting is necessary. The body is not permitted to continue with behaviour which might seriously damage vital tissues. Occasionally people of unduly phlegmatic temperament engaged in occupations not requiring skilled concentration, or people acting under a severe emotional urge, overstep these limits and pay with their lives.

How Heat Affects the Circulation.

How does exposure to hot surroundings affect the circulation so that ill effects are apt to ensue? To deal properly with that question would take us into a fairly long and technical discussion; but I think I can give you a fairly simple idea. When the temperature of the skin is raised, all the myriads of tiny blood vessels in it get bigger. This is partly a direct effect of heat, and partly due to the action of the nervous system on these blood vessels. The purpose of this is to allow more blood to pass more quickly through the skin and allow more heat to be lost from it. So long as only a fairly small proportion of the skin surface is heated, or so long as the heating is only moderate, nothing untoward happens. If, however, the blood vessels of a very large area of skin are very much dilated, then the total volume of the blood vessels in the body is very much increased, and there is not enough blood to fill them.

Now you all must have experienced the sensation of working a pump when there is not enough water or kerosene to fill it. The pump wastes its energy on nothing and a very irregular flow comes out. Something of this nature happens when there is not enough blood to fill the blood vessels. Indeed, the result of enlarging the vessels while the amount of blood remains the same is very much the same as that of taking away a lot of blood while the vessels remain the same size, and everyone knows what happens when one loses a lot of blood.

Results of Circulatory Inefficiency.

When there is not enough blood to fill the blood vessels, many parts of the body begin to suffer from lack of blood supply. All parts do not suffer to the same extent since some tissues are much less particular

about this than others. Moreover, people vary a good deal in these matters; so that, while one man complains of drowsiness, another complains of indigestion, and a third of fatigued muscles. The symptoms displayed by a deprived nervous system I have mentioned—lassitude, irritability, drowsiness, lack of concentration, dull headaches, and, eventually, fainting. The digestive system signals its protest by loss of appetite (although a certain amount of this is desirable), a feeling of sickness, the vague discomforts we speak of as indigestion or constipation. The feeling of intense muscular fatigue is partly due to loss of nervous power, but partly also to direct muscular protest against a poor blood supply.

Prevention and Cure.

Training is the great factor in preventing circulatory distress. Of course, there are conditions which no self-respecting system can be asked to endure; but, in general, the circulation can be trained to a remarkable degree, as is evidenced by the tremendous feats of well-trained athletes. Common sense is the great principle in training, which dictates a continual but gradual increase of the demand upon the individual adjusted to the individual's response.

Avoidance of all abuse and excess—including the excess of cutting out everything—is essential. Categorically to forbid all popular pleasures is as detrimental as sanctioning unbridled indulgence.

The use of a good mixed diet, a liberal addition of salt, and the drinking of as much plain fluid as is desired go a long way toward helping the circulatory system in its job.

WIND BREAKS FOR BANANAS.

During the recent cold snap, the desirability of retaining suitable windbreaks around banana plantations has been indicated by the number of plantations which have been frosted.

As growers are now falling scrub to plant fresh areas, the necessity of retaining a belt of scrub about 2 chains wide around new areas cannot be too strongly stressed. Where the ground is definitely liable to frosting, it is a good plan to make the track through the scrub or forest into the plantation on a zigzag formation. In areas not liable to frosting, a windbreak will greatly assist in keeping out cold winds which chill the plants and thus retard their growth.

Where plantations are already established, growers should give attention to the planting of windbreaks, of which two types are easily made. Lady's Finger or Sugar bananas planted in close formation round the plantation will produce a thicket, and so afford protection. Several border rows of Java cane will also give some protection against frost and wind.

Growers should remember that too much hard work is put into falling scrub, burning off, logging up, and planting areas to excuse the neglect of reasonable precautions against the possible damage to bananas from frost or cold winds, for one severe frosting followed by a warm day will render their plantations worthless.

W. E. Hamley.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Para Grass.

A.M. (Townsville)—

The specimen is *Brachiaria mutica*, the Para grass, better known in Queensland as *Panicum muticum*. There is no doubt about the palatability and valuable qualities of this grass as a pasture, and for growing in many parts of coastal Queensland in wet places or under cultivation, it is one of the best species that could be planted. It sets very little fertile seed, but it may be propagated easily by cuttings, which root readily and, during the wet season, grow very rapidly.

Bindweed.

A.W. (Kulgun)—

The sample sent by you represents the Bindweed, *Convolvulus arvensis*. This is a native of Europe, now naturalized as a weed in most temperate countries. It is an exceedingly bad weed-pest in the Southern States in Europe, and in North America. It has made its appearance in Queensland on different occasions, but does not spread here to the same extent as it does further south, and seems to be confined to a few isolated patches.

If the patch is only a small one, it is probably better not to disturb the ground, but to cut the green shoots down as they appear. A weak arsenical solution poured into the patch could be tried. It is, generally speaking, better to use a large amount of weak solution, than a small amount of strong. If it is decided to fork the plant out, care should be taken that the underground parts are not carried about, as even a small piece dropped, may develop into a new plant.

Pigs are fond of both the underground and above-ground growth of Bindweed, and where it is very bad, if the land is ploughed, the pigs will help in removing the underground parts. They have been quite successful for this work in Queensland in the few patches where the weed has made its appearance.

Bristle Poppy.

Inquirer (Jondaryan)—

The specimen forwarded by you bears no flowers, but we should say it is the bristle poppy or spiny poppy (*Papaver aculeatum*), a plant with rather a peculiar distribution, being found in the Eastern Australian States, and in South Africa.

In the Southern States, it is a minor weed-pest, but is not so abundant in Queensland, and so far as we have observed, has not proved itself an aggressive pest.

Valuable Fodder.

F.P. (Maleny)—

Brachiaria mutica, better known in Queensland as *Panicum muticum*, also as Para grass and giant couch, is an excellent, nutritious, and palatable fodder, and a small paddock of it is very useful for periodical feeding off. It does not do particularly well in Southern Queensland in the ordinary pasture, but requires cultivation or rather damp conditions. It is particularly useful for growing along creek banks or in swampy localities. It is frost tender. It is not known to be poisonous or harmful at any stage of its growth. It is propagated from cuttings. The seed, generally speaking, possesses a very low percentage of fertility.

Ivory Wood.

J.H. (Porter's Gap, via Bell)—

The specimen you sent me is the Ivory Wood, *Siphonodon australe,* a native of the drier scrubs of Southern Queensland. The fruits are not known to possess any poisonous properties. They were said to be eaten by the aborigines in the early days, but they always seem to be too hard and woody to be of any value as food.

Wattle and Grasses.

K.E. (Chinchilla)—

The smaller wattle in flower is *Acacia decora.* We have not heard a local name given to it, though it is exceedingly common on parts of the Darling Downs, Maranoa, and Burnett districts. It is certainly very decorative, and the specific name is quite appropriate.

The wattle in flower is *Acacia Cunninghamii,* commonly known in Queensland as black wattle.

The tall oat grass of the Darling Downs is *Themeda avenace,* the genus *Anthistiria* having given way to *Themeda* on the score of priority.

Kangaroo grass is *Themeda australis.*

From your description, we think that Leichhardt's "vitex" must have been the sandal-wood or budda, *Eremophila Mitchellii.* This is certainly very common and rather a beautiful sight when in flower.

Wilga is *Geijera parviflora.* We were very interested in your remarks on the advancement of the brigalow in the Dawson country. We certainly think that the brigalow and mixed soft-wood scrub is the dominant type, and as your informant says, has spread gradually over the plains. We have seen a form of brigalow and mixed scrub in the making.

Serious Menace, Common Weeds.

Inquirer (Toowoomba)—

The European Bindweed, *Convolvulus arvensis,* is one of the worst of the European and North American weeds. It is fairly common in the Southern States. It has appeared in Queensland at different times, and during the past five or six years it has been seen several times as a weed of the Darling Downs, mostly in small patches in cultivation areas. Fortunately, it does not seem to spread here to anything like the extent it does in more temperate places, but it is certainly a very serious menace, and there is no telling when it will spread to a greater extent than it is doing at present.

The only suggestion we can offer is the one you have made, namely, spraying with a weak solution of weedex or other weed spray, each time any fresh growth appears. This will eventually exhaust the underground root stock. It may be advisable to fork the patch over and spray the patch; but, of course, care must be taken that the pieces are not carried from one part of the farm to another as every little piece of the plant dropped, is capable of forming a fresh patch. Mr. W. Deacon, M.L.A., formerly Minister for Lands, told us that he had a few patches of this weed on his farm, and found that pigs were very useful in getting rid of it, being very fond of the white, underground parts. Pigs have been used elsewhere to aid in its eradication; the only thing against it in Queensland is that at present the plant is mostly found in very small patches, and pigs might easily spread it about from one part of the farm to another.

Inquirer (Mareeba)—

Crotalaria sericea is a native of India, but is now a very common weed in Queensland, being found along the coast from Brisbane to the far North. It is a showy, rather attractive plant, and has been suspected on one or two occasions of poisoning stock. Nothing definite, however, is known about it and so far as we have observed, stock seem rarely to eat it in any quantity. Though a fairly abundant weed in parts, we cannot say that it is fairly aggressive or that it calls for particular means of eradication. It is very close, if not conspecific, to a species that has been imported into Queensland, namely *S. spectabilis.*

East Moreton Plants Named.

G.G. (Mount Beppo)—The specimens have been determined as follows:—

1. *Echinochloa Crus-galli,* wild millet. This grass is very closely allied to such well-known cultivated fodders as Japanese millet and white panicum.
2. *Setaria glauca,* a pigeon grass. This grass is closely allied to such well-known cultivated fodders as Manchurian millet and Hungarian millet. It mostly occurs either as a weed of cultivation or in damp pastures.
3. *Eragrostis pooides,* a species of love grass. The love grasses are very common in Queensland, and, though only of secondary value as fodders, probably play some useful part in the general mixture.
4. *Paspalum dilatatum,* common paspalum.
5. *Eleusine indica,* crowfoot grass. This grass is very widely spread over the sub-tropical and warmer regions of the world. It is very common in Queensland, and mostly occurs as a weed of cultivation. It contains a prussic-acid-yielding glucoside, but very little trouble is experienced from it in Queensland.
6. *Chloris virgata,* feather topped Rhodes grass, or woolly topped Rhodes grass. This grass is very common in many parts of Queensland, and though rather a luscious-looking grass, is not generally eaten by stock to any great extent. They seem to eat it readily enough, however, in the form of hay. This grass has invaded much of the lucerne-growing country of South Queensland, particularly in the Lockyer valley, and has decreased very considerably the earning capacity of some of the lucerne paddocks.
7. *Chloris divaricata,* a star grass. The native star grasses or windmill grasses are mostly good fodders, making good bottom feed, particularly for sheep.
8. *Themeda australis,* kangaroo grass, a very valuable native grass, but does not stand up to heavy stocking.
9. *Chloris gayana,* Rhodes grass.
10. *Eriochloa sp.,* sometimes known as early spring grass in Queensland. They are good fodders, but the local name is not particularly appropriate, as they are not much earlier, or any earlier, than many other native grasses which come up with early summer rains.
11. *Digitaria marginata,* summer grass, a useful fodder, mostly occurs as a weed of cultivation or in rather sandy tracts in the pasture.
12. *Bothriochloa decipiens,* bitter or pitted blue grass. This is an inferior species of blue grass, sometimes called coastal blue grass. It is the dominant species in many pastures, due to the better and more palatable kinds being eaten out.

Some Poison Plants.

J.H.McL. (Kilkivan)—

1. *Solanum seaforthianum,* a native of tropical America, now a common naturalized weed in many scrub areas in Queensland. It belongs to a dangerous family, and the berries have been accused of poisoning children, though not fatally and of poisoning poultry. So far as we have observed, stock rarely touch the plant, as it has a rather nauseating flavour. We should say, however, that it would be decidedly unwholesome.
2. *Solanum nigrum,* black night shade. The ripe berries of this plant are frequently eaten by children without any ill effects following, but the green berries and green parts generally contain a poisonous principle solanin, which tends to disappear in the ripe fruits. The green parts of this plant are poisonous, but rarely seem to be eaten by larger stock such as cattle in sufficient quantities to cause trouble.
3. *Rivina laevis,* a very common weed in many scrub areas in Queensland, but one for which we have not heard a distinctive local name. It is not known to be poisonous or harmful in any way, but gives a rather offensive taint to milk and cream.
4. *Rhynchelytrum repens,* red natal grass. This grass is a very common grass in many parts of Queensland, particularly as a weed of cultivation. It is only of secondary value as a fodder; in coastal areas it is a very common weed on fruit farms, and has been found there to make excellent chop-chop for horses, and for dairy cows, either by itself, or mixed with better class fodders. It is not known to be poisonous or harmful at any stage of its growth.

Grasses and Sedges.

A.H. (School Project Club, Jandowae)—Nos. 1, 2, and 3. No specimen received.

4 and 5. *Eragrostis parviflora*, weeping love grass, a very common grass in Queensland pastures, particularly in the damper situations. The love grasses, on the whole, are of only secondary value as fodders, but, nevertheless, play perhaps an important part in making up the average native mixed pasture.

6 and 7. *Aristida calycina*, a three-pronged spear grass or wire grass. On the whole, they are of little value as fodders, though they will be eaten by cattle to some extent when young.

8. *Tragus racemosus*, small burr grass, a very common grass in many parts of Queensland, particularly on the Downs country. It provides a bite for sheep, but is of little value for larger stock. The burr-like seeds are an objectionable feature.

9 and 10. *Chloris virgata*, feather top Rhodes grass, or woolly top Rhodes grass. This grass, though rather a luscious-looking grass, is apparently unpalatable to stock. It has invaded much of the lucerne-growing country in Southern Queensland, particularly in the Lockyer valley, and has much reduced the earning capacity of some of the lucerne paddocks. Stock are said to eat it readily enough in the form of hay.

11 and 12. Very young specimens, but apparently the same as No. 4.

13. *Bothriochloa intermedia*, forest blue grass. This is the commonest native grass in much country on the Northern Darling Downs, the Burnett district, and Callide valley.

14. *Chloris gayana*, Rhodes grass.

15. *Eragrostis leptostachya*, paddock love grass. (See note on No. 4.)

16, 17 18, 19. *Cyperus difformis*, a sedge, not a true grass. The sedges, on the whole, have not the same value for fodder as the true grasses. A book soon to be published by the Department of Agriculture and Stock on "Principles of Botany for Queensland Farmers" will give you the differences between grasses and sedges. You should get your head teacher to obtain a copy for the school library.

20. *Eriochloa sp.*, early spring grass. The early spring grasses are very palatable fodders. The local name is not particularly appropriate, for though they come up with the early summer rains, they are no earlier than many other of the native grasses.

21. *Echinochloa colona*, wild or barnyard millet, a valuable fodder grass, closely allied to such well-known cultivated fodders as Japanese Millet or white panicum. It is mostly found either as a weed of cultivation or in damp spots in the pasture.

22, 23, 24, *Eriochloa sp.* (See notes under No. 20.)

25. *Eragrostis ciliancnsis*, stink grass, a native of Southern Europe, now a common naturalized weed in most warm temperate countries. In Queensland it is mostly found as a weed of cultivation, and, on the whole, is not eaten to any great extent by stock. The name stink grass comes from peculiar glands along the edge of the leaf, which give it the characteristic and not altogether unpleasant odour.

26. *Chloris ventricosa*, a star or windmill grass; the native chloris grasses or windmill grasses are valuable fodders.

27, 28. *Alternanthera denticulata*, a weed of the Amaranth family. (Amarantaceae). We have not heard a common name applied to it, but it is generally regarded as quite good fodder for stock.

29. Looks like a form of *Eragrostis parviflora*, weeping love grass.

30. *Sorghum sp.* This is either sudan grass, *S. sudanense*, or the wild sorghum, *Sorghum verticilliflorum*, but more complete material is required to be certain.

31. *Apsium leptophyllum*, wild carrot, a common weed of cultivation, and sometimes seen in ordinary pastures. It taints milk rather badly.

32. *Digitaria marginata*, summer grass, a very common grass in Queensland, mostly seen as a weed of cultivation—sometimes in the more sandy pasture country. It is quite a good fodder.

33. Looks like a species of *Commelina*, but specimen too poor to be sure. Species of Commelina are sometimes called scurvey grass in Queensland, and the leaves make quite a good vegetable, but they are some trouble to collect.
34. *Amarantus interruptus*, a very common weed of the Amaranth family (Amarantaceae). Probably quite a good fodder.
35. *Eragrostis elongata*, a love grass. (See remarks on No. 4.)
36. No inflorescence, but looks like nut grass, *Cyperus rotundus*. This is a sedge, and not a true grass.
37. *Setaria glauca*, a pidgeon grass. This grass mostly occurs either as a weed of cultivation or in damp spots in the pasture. It is very closely allied to such well-known cultivated fodders as Hungarian millet, Manchurian millet, &c.
38. *Heleocharis plana*, a sedge, not a true grass.
39. *Cyperus sp.* Inflorescence too broken to identify. This is also a sedge.
40. *Cyperus concinnus*, a sedge. The inflorescence is too young to be sure of its specific name.
41. *Sporobolus pallidus*, fairy grass.
42. *Cyperus laxus*, a sedge.

Wild Millet.

F.C.T. (Goondiwindi)—

The grass is wild millet, *Echinochloa Crus-galli*, which is widely spread over the warm temperate regions of the world. It is a very good fodder, and is closely allied to such well-known cultivated grasses as Japanese millet and white panicum. In Queensland it mostly occurs either as a weed of cultivation in country where the ground has been disturbed, or in rather damp situations in the pasture. We should thing it worth encouraging and trying in a new burn.

Varying Fodder Values.

F.J.I. (Miles)—

1. It is difficult to name grasses in the absence of seed-heads, but the present specimen appears to be *Cynodon dactylon*, the common couch, a very nutritious and palatable fodder grass, but not making very heavy growth.
2. *Aristida caputmedusae*. This is one of the wire grasses or three-pronged spear grasses. It is very common in sandy forest country on the Darling Downs and Maranoa districts. It has a very limited use as a fodder, but will be eaten by stock, particularly cattle, in its younger stages.
3. *Perotis rara*, comet grass, a very common grass in many parts of Queensland. The local name comes from the similarity of the seed-spike to the tail of a comet. It has little value as a fodder, but perhaps is of some importance in making up the general mixed native pasture, particularly on poorer-class country.
4. *Eleusine indica*, crowfoot grass, a very common grass widely spread over the warm temperate and sub-tropical regions of the world. In Queensland it mostly occurs as a weed of cultivation, and is moderately palatable. It contains a prussic-acid-yielding glucoside, but trouble from it in this State is very rare. The grass, of course, is not to be confused with crowfoot, the common herbage of the Darling Downs.
5. Impossible to determine from the material sent. May be a rush or a sedge, but flowers or seed-head required.

Blue Panic Grass.

D.C. (Chinchilla)—

The specimen forwarded was in a very young state; but there is no doubt it represents the blue panic or giant panic, *Panicum antidotale*. This grass has received a good deal of publicity of recent years, and it is undoubtedly quite a valuable standing feed, although, so far as we have observed, it seems to do best under cultivated conditions. It makes rather a caney stem, but sends tufts of leaves out here and there at different points along the main stems, and these are much relished by cattle. Seed is obtainable through the ordinary commercial channels.

Grasses and Weeds.

J.C. (Calvert)—

1. *Cyperus difformis*, a sedge. In a work shortly to be published by the Department of Agriculture and Stock on "Principles of Botany for Queensland Farmers," the difference between sedges, grasses, and allied plants will be given.
2. *Achyranthes aspera*, chaff burr, a common weed in many parts of Queensland, both on the coast and inland. It is not known to possess any poisonous or harmful properties, and we cannot say that we have seen stock eat it to any extent.
3. *Alternanthera denticulata*, a weed of the amaranth family (Amarantaceæ). We have not heard a local name applied to it. It should be quite a useful fodder.
4. Looks like *Stachys arvensis*, stagger weed or wild mint. This plant causes shivers or staggers in working or travelling stock. Ordinary resting paddock stock such as dairy cattle, cows, &c., eat the plant with impunity. In fact, for them it seems quite a useful fodder.
5. *Teucrium argutum*, a native weed for which we have not heard a common name. When it grows in cultivation paddocks, it possesses white underground runners, which are much liked by pigs. When eaten, however, they cause animals to become highly excited and rush about until they become exhausted.
6. *Chenopodium carinatum*, a weed of the saltbush family. It contains a prussic-acid-yielding glucoside, and has been known to kill sheep in New South Wales.
7. *Chenonpodium triangulare*, fishy weed, a plant of the saltbush family, not much eaten by stock in the green stage, but when made into hay seems to be quite palatable. The green plant, if eaten by cows, imparts rather a fishy flavour to milk and cream, hence the local name.
8. *Panicum decompositum*, barley grass.
9. *Eragrostis leptostachya*, paddock love grass. The love grasses are not particularly good fodders, but nevertheless play rather an important part in the mixed native pasture.
10. *Zornia diphylla*, a native legume for which we have not heard a local name.
11. *Cyperus concinnus*, a sedge.
12. *Eragrostis parviflora*, weeping love grass.
13. *Cassia bicapsularis*, a native of tropical America, now widely cultivated as a garden shrub in most warm countries. It is most frequently known to nurserymen as *Cassia candolleana*.
14. *Jasminum suavissimum*, a native jasminth.
15. *Geranium dissectum*, native geranium, a useful fodder.

Arsenic Weed.

G.R.S. (Biggenden)—

The specimen forwarded by you under the name of Arsenic Weed is *Cassia sophera*, a native plant very widely scattered through Queensland. It has been suspected of causing losses among stock at different times, but We have not seen stock eat it to any extent. If eaten by them, it is almost sure to have a purgative effect, as it belongs to the same genus as the shrub producing the senna leaves of commerce. We have been told, and the evidence seems fairly good, that deaths have been caused by feeding on the young shoots of this weed. In respect to the local name, however, there is no connection, we should say, between the arsenic found in the stomach of the poisoned cow and this weed.

Grass out of Favour.

E.R.A. (Bowen)—

The specimen represents *Paspalum urvillei*, a native of Southern Brazil and the Argentine. This grass was boomed as a fodder some years ago, under the name of *Paspalum virgatum*, but has since gone out of favour.

Weeds of Cultivation.

G.R.S. (Biggenden)—

1. *Indigofera hirsuta*, hairy indigo, a fairly common weed of cultivation in many parts of Queensland, particularly in the Central coastal districts. Personally, we have not known stock eat it to any extent, but have been told by several experienced stockowners that both cattle and horses eat it readily enough, particularly when drying off slightly.

2. *Deeringia celosioides*, a very common plant of the Amaranth family (Amarantaceæ). It mostly grows in the rather drier scrubs, on scrub edges, and is frequently common in the Burnett and Callide Valleys as secondary growth. We have not heard a local name given to it. It is not known to possess any poisonous or harmful properties at any stage of its growth.

3. *Malvastrum spicatum*, a very common weed of the mallow family. We have not heard a distinctive local name given to it. It is sometimes called *Sida retusa*, but the true *Sida retusa* is a rather different plant.

4. *Cenchrus australis*, hillside burr grass, or scrub burr grass. This grass is very common throughout the coastal and near coastal belt of Queensland. It is particularly abundant along scrub edges. We should not say it had much value as a fodder. It is a very common weed of parts of the Atherton Tableland, and is known there by the rather absurd name of scotch lice. Insects sometimes get entangled and caught in the hooked burrs of the seed-head.

Fodder Grasses.

W.E.T. (Mitchell)—The three specimens have been determined as follows:—

1. *Chloris virgata*, feather top or woolly top, sometimes called feather top or woolly top Rhodes. This grass mostly occurs in Queensland as a weed of cultivation. It is rather a luscious-looking grass, but on the whole we have found that stock do not eat it very readily. It is said to be much more palatable in the form of hay. Of recent years this grass has very badly infested many of the lucerne-growing districts, and very much reduced the earning capacity of some of the lucerne paddocks.

2. *Echinochloa colona*, wild millet. This grass is a very good fodder, and is closely allied to such well-known cultivated fodders as Japanese millet and white panicum. In Queensland it mostly occurs either as a weed of cultivation or in rather damp places in the pasture.

3. *Eleusine indica*, crowfoot grass. We have heard this grass called holdfast, on account of the very tenacious hold it has on the soil. It is moderately palatable to stock, but, like sorghum and some other fodders, contains a prussic-acid-yielding glucoside. Very little trouble, however, is experienced with it in Queensland. It mostly occurs where the ground has been disturbed, such as old cultivation areas, around cowyards, and along railway embankments, and is not usually seen as a member of the ordinary pasture.

All grasses are summer growers.

Madagascar Plum. Mesquite Bean.

"Sap" (Townsville)—

The fruit forwarded by you is *Flacourtia cataphracta*, commonly known in Queensland as the Madagascar plum. It is a very pleasant fruit to eat, and the reason why some trees are barren is that the male and female flowers are borne on distinct trees.

The bean forwarded under the name of Urandangie pest is the mesquite bean, *Prosopis juliflora*, a native of South America, the West Indies, Central America, Mexico, and the southern United States. It is now widely cultivated in tropical countries as a fodder and ornamental tree. We have realized, however, the possibility of this plant becoming a pest in Queensland, somewhat in the same way as the Parkinsonia Tree has in parts of New South Wales. Any particulars you could give about the spread of this tree about Urandangie would be much appreciated.

Potato Bush.

M.L. (Brisbane)—

The specimen forwarded by you is a species of Solanum or Potato Bush. A number of these are naturalized in Queensland, and are very common on much of our pasture country on the Downs and inland generally. The piece you send is a very small piece indeed, and as many of these are so much alike, we would very much like to have a larger specimen to make sure, but yours is either *Solanum ellipticum*, the spiny potato bush, or *Solanum cinereum*, the narrawa burr. These plants are at times very common, but we have not seen them in sufficient quantities to class them as a serious pest.

Salt Weed.

Inquirer (Cunnamulla)—

The specimen forwarded represents the shrub salt wort or salt weed, *Arthrocnemum halocnemoides*, sometimes called the shrub glass wort, or glass weed, due to the fact that these plants are rich in soda. An allied species in the early days was used in Europe in the manufacture of glass. It belongs to the saltbush family (Chenopodiaceæ).

Crowfoot.

J.J.S. (Helidon)—

It is rather difficult to name specimens of plants in the very young stage, but we do not think there is any doubt that yours represents the Crowfoot, *Erodium cygnorum*, a very common herb on the Downs country and Southern Queensland. It belongs to the geranium family (Geraniaceæ). It is not as valuable a fodder as the native geranium.

A Good Native Grass.

M.J.C. (Westwood)—

Your specimen proved to be *Brachiaria praetervisa*, a native grass, quite a good fodder, but one for which we have not heard a local name. Practically all the brachiarias are useful fodder grasses, but the present one, like others, seems to prefer cultivated ground, or ground that has been disturbed, rather than the ordinary pasture. This is unusual in native grasses.

Leguminous Herb. "Devils' Fig."

B.D. (Ingham)—

1. *Cassia mimosoides*, a common leguminous herb of rather woody character, usually found in grass country throughout coastal and North Queensland. It is not known to possess any particular properties, useful or otherwise. We have not seen stock eat it to any extent, but it would probably be quite a useful fooder. Some of the cassias cause purging.

2. *Solanum torvum*, a very common weed, widely spread over the tropical countries of the world. It is quite common in parts of coastal Queensland and in some areas is regarded as rather a serious pest. It is most frequently known as "devil's fig."

Possibly Valuable Legume.

Inquirer (Brisbane)—

The specimen from Gracemere is *Stylosanthes guineensis*, several of which have been imported at different times following on the success that an allied species, *S. sundaica*, has been in parts of Queensland. This latter species has certainly very much improved the carrying capacity of much of the country in North Queensland, particularly about Townsville. We have seen several specimens of the plant, but have not seen fertile seed. This does not say, of course, that fertile seed is not produced, but unless it is, the plant is of very little value for Queensland. If it does produce fertile seed, then we think it is a valuable legume, and should approximate lucerne in feeding value. It will grow under more tropical conditions than ordinary lucerne, and is valuable in this respect. We have found with *S. sundaica*, the common Townsville lucerne or wild lucerne, that stock prefer it in a wilted condition to green and luxuriant.

Scrub Panicum.

Inquirer (Brisbane)—

The specimen submitted is the *Setaria australiensis,* commonly called in Queensland the scrub panicum, a native grass frequently seen around scrub clearings, along scrub tracks, etc. It is generally regarded for such places as quite good fodder, but it is hardly worth cultivating, for where it should grow, better fodders, such as giant setaria or Manchurian millet, which are very closely allied to it, would grow equally well. Seed of the scrub panicum is not stocked by nurserymen, but the giant setaria is obtainable through commercial channels at a fairly cheap rate.

Galvanised Burr.

Inquirer (Pittsworth)—

The *Bassia birchii,* or galvanised burr, a sample of which you have sent, is a native of Central Queensland. Within comparatively recent years it has spread over much land, particularly on stock-routes, or on land that is heavily stocked. It has caused some concern to graziers, and the Council of Scientific and Industrial Research is carrying out experiments on the weed in the neighbourhood of St. George.

Gooseberry Cucumber.

J.P.D. (Kingaroy)—

One of the specimens sent is the Gooseberry Cucumber or Paddymelon, *Cucumis myriocarpus,* a native of South Africa. It is now very common as a weed in many parts of Queensland, particularly on the Darling Downs. It is generally regarded as harmful to stock, but feeding experiments in Australia, so far as we know, have given negative results. In South Africa, however, it has been proved that the watery sap is poisonous, particularly that of the ripe fruits. The rinds and seeds are quite harmless. The symptoms are severe purging, and in some animals, vomiting.

Native Pasture.

C.C. (Maryvale)—

Your specimen represents the common Kangaroo grass, *Themeda australis.* This is a native grass. It is one of the better grasses of the native pasture, although, when it becomes mature, it is rather fibrous. It is considered to be a fairly good fattening grass for cattle, although some of the softer kinds of grasses, such as the native panicums, form a useful addition to the pasture.

Leguminous Plants.

"Sap" (Townsville)—

What you have sent is *Atylosia scarabaeoides,* a leguminous plant, which is widely spread in India and Malaya, and parts of Melanesia. Unfortunately, we have no records of its fodder value. However, as you say it is readily eaten by stock, we think that is a fair indication that it is a good fodder plant. Many native leguminous plants are strictly avoided by stock, and this gives one the impression that they are either unpalatable or harmful.

Indian Heliotrope.

Inquirer (Rockhampton)—

Heliotropium indicum (Indian Helliotrope) is a native of tropical Asia, but is now a naturalised weed in parts of Queensland. It is particularly abundant about Rockhampton. It is not known to possess any poisonous or harmful properties.

Wild Sunflower. Black Nightshade.

F.A.S. (Columboola, W. Line)—

(1) *Verbesina encelioides,* wild sunflower. This plant has been definitely proved by feeding tests to be poisonous to sheep.

(2) *Solanum nigrum,* black nightshade. The green parts of most *solanums* are poisonous to stock. If the present plant were eaten to any extent it would be harmful. It is not usually eaten by stock in sufficient quantities to cause trouble, although the specimens you sent show marked signs of having been trimmed by stock.

General Notes

Staff Changes and Appointments.

Messrs. P. A. Kelly and R. E. Watson, inspectors of dairies, Department of Agriculture and Stock, have been transferred from Oakey to Goombungee and Goombungee to Oakey, respectively.

Constables V. Jensen (Thangool) and F. A. S. Goodwin (Jundah) have been appointed also inspectors under the Slaughtering Act.

Mr. W. J. Richardson, cane tester, has been transferred from the Babinda Mill to Tully Mill. Miss M. A. Morris has been appointed a cane tester at the Babinda Mill, and Mr. C. W. Steley an assistant cane tester at the Tully Mill, Tully.

Constable W. Mollenhauer, Isisford, has been appointed also an Inspector under the Slaughtering Act.

Senior Sergeant E. O. Hall, Charleville, has been appointed also an Inspector under the Slaughtering Act.

The following have been appointed assistant cane testers for the forthcoming sugar season at the mills indicated:—Miss D. Aldridge (Millaquin), Mr. R. Anderson (Fairymead), Miss K. Backhouse (Moreton), Mr. A. Byrne (Millaquin), Miss P. Eadie (Bingera), Mr. G. R. Kronk (Maryborough), Mr. J. Kinnon (Fairymead), Mr. C. M. Martin (Bingera), Mr. R. A. Stephenson (Moreton), Mr. W. P. Snewin (Isis), and Miss P. Thorburn (Isis).

Mr. J. Wagner, Howes and Melton roads (Nundah), has been appointed an honorary ranger under the Animals and Birds Acts.

Mr. R. C. Cannon, B.Sc.Agr., Field Assistant, Department of Agriculture and Stock, has been appointed Instructor in Agriculture, Dimbulah.

The following have been appointed cane testers for the forthcoming sugar season at the mills specified:—Messrs. C. J. Boast (Isis), P. H. Compton (Bingera), T. F. Corbett (Moreton), T. D. Cullen (Millaquin), T. Herbert (Gin Gin), L. C. Home (Mount Bauple), J. Howard (Rocky Point), J. McFie (Maryborough), and Misses A. L. Levy (Fairymead) and J. O'Flynn (Qunaba).

Boundaries of Northern Stallion District.

A Proclamation has been issued under the Stallions Registration Acts altering the boundaries of the Northern Stallion District to include the Petty Sessions Districts of Ingham, Herberton, Atherton, and Mareeba.

Sectional Group Committee Electorates.

Regulations have been issued under the Fruit Marketing Organisation Acts providing that, for the purpose of electing members of the Banana, Pineapple, Citrus, Deciduous, and other Fruits Sectional Group Committees, certain local producers' associations and groups of associations throughout the fruitgrowing districts of the State shall constitute electorates, and shall elect the members of the various sectional group committees.

Qualifications in Veterinary Science.

An Order in Council has been issued in pursuance of the provisions of "*The Veterinary Surgeons Act of* 1936" providing that the degree or diploma in veterinary surgery of the Royal College of Veterinary Surgeons, Great Britain, the United States College of Veterinary Surgeons, America, the Universities of Sydney, Melbourne, and Queensland, shall be recognised as entitling the holder or member, as the case may be, to practise as a veterinary surgeon. For the purposes of the Act also an Order in Council has been issued declaring the Queensland Agricultural High School and College, the Hawkesbury Agricultural College, and the Wagga Experimental Farm, New South Wales, the Roseworthy Agricultural College, South Australia, the Dookie Agricultural College, Victoria, and the Muresk Agricultural College, Western Australia, to be Institutes affording a training in veterinary science.

Wild Life Preservation—A Goondiwindi Sanctuary.

A sanctuary under the Animals and Birds Acts embracing the property of Mr. P. A. Wright, "Kindon," Goondiwindi, has been declared. Mr. C. D. McKenzie, manager of "Kindon," has been appointed an honorary ranger under the Acts.

Rural Topics

Whitewash Hints.

Whitewashing is usually regarded as a very poor substitute for painting, but when properly done it has many uses for which paint is not suitable. One advantage is the ease and rapidity with which it can be applied, and its cheapness is another recommendation. The surface to be whitewashed should be just as clean as one that is to be painted, and it is a first essential to good results that all dirt, dust, grease, and scaly material should be removed before there is any attempt to apply the wash. This implies a liberal use of scrapers and stiff brushes. When the cleaning is finished, and the surface dusted, it is well to dampen it slightly just before applying the wash. Whitewash may be applied with the brush or sprayer. Let the coat be fairly thin and transparent and it will be opaque when dry. In using sprayers it is necessary that the wash be strained through at least two thicknesses of cheese cloth. In estimating the quantity of material required many problems and conditions are encountered, but the following general figures may be used as a basis: One gallon of whitewash will cover approximately 225 square feet of wood, 180 square feet of brick, and 270 square feet of plaster. Using a 4-inch brush a man will cover 200 square feet of ceiling, 200 square feet of rough wall, or 350 square feet of smooth wall in one hour. Prepare the lime and water paste a few days before using. Where casein, glue, or formaldehyde are to be used, the solutions must be brought together only when they are quite cold. This is very important. The solutions mentioned should be added very slowly and at the same time they should be stirred vigorously and constantly.

In no case should you mix more of the wash in one day than you can use in that day when using any of the solutions mentioned above. Skim milk may be used as a substitute for casein, but it is not quite so effective. In place of one sack (50 lb.) of hydrated lime, you may use the paste made by slacking ½ bushel (38 lb.) of fresh quick-lime with about 6 gallons of water. This slaking is sometimes done by placing the quick-lime in a barrel and adding the water boiling hot. If cold water is used the water may be added a little at a time, stirring each time; when heat ceases to be given off the lime is slaked. Before using, strain this paste through a fine screen.

Molasses is said to render the lime more soluble and to give it a greater penetrating power. Use in proportion of 1 pint of molasses to 5 gallons of the wash. Alum tends to prevent rubbing and is used in proportion of 1 oz. to 1 gallon of the wash. If a gloss is desired, dissolve 1 lb. of bar soap in a gallon of boiling water, and when it is cold add to 5 gallons of the thick wash.

Two Weeds Poisonous to Stock.

On the Darling Downs, in the Maranoa district, and in some other parts of Queensland, there is a very common weed sometimes seen in cultivation and along watercourses. It is upright in growth, about 3 feet high, with white flowers followed by a spiny seed pod, splitting at the top into four parts, and containing a large number of blackish seeds. In the districts mentioned it generally goes under the name of castor oil and the question is often asked if it is the true castor oil of commerce.

The fact is that the true castor oil is a different plant. The seed pods are superficially alike, but the plant is very much larger. Instead of being a small weed of cultivation, it is a shrub, or even a small tree, up to 10 feet high. It is very common around vacant allotments in coastal towns, and along creek and river banks in the near coastal districts. The seeds of the true castor oil are also poisonous and have sometimes been eaten in the mistake that they would have the same effect as a dose of castor oil. People who have accidentally or intentionally eaten the seeds have become violently ill, and it is said that in some cases even death has ensued. When the oil is expressed from castor oil seeds the residue contains a poisonous principle and this precludes the use of castor oil cake as a stock food.

The other plant is stramonium or thorn apple, and all parts of this plant are poisonous. It possesses a nauseating odour and flavour, and, on this account the standing plant is rarely eaten by stock. On several occasions, however, the seeds and parts of the dried plant have been found as an impurity in chaff and have caused the deaths of working horses and town cows. The seeds of this plant are the most poisonous part and poultry should not be allowed to run where the plant is growing.

Stock Foods and Feeding.

To get the best returns from their livestock, producers should know not only the best combinations of foods, but the mechanical condition in which they should be given.

Broadly speaking, foodstuffs may be classed as concentrates and roughages; and the type of animal and the purpose for which it is used should determine the condition in which the foodstuffs are fed.

No stock owner should purchase equipment for chaffing, grinding, crushing, soaking, or cooking foodstuffs until he is convinced by trial that the extra returns will repay the cost.

The argument most commonly advanced in favour of prepared foods is that there is a saving in the energy normally expended in biting, grinding, and digesting, and that this saving may be diverted to extra production.

This is only a half-truth. Nature has given every animal an efficient mechanism for digesting and assimilating food and, if this intricate mechanism is, through the agency of man, prevented from functioning normally, it may not function as nature intended, with the result that the animal will not thrive as well as it should.

Under the modern system of selective breeding and intensive feeding it becomes necessary at times to convert some foods into more readily digested forms; but it must not be assumed that the success obtained with one class of animal, or one type of food, is applicable to all classes and types.

European and American findings have been correlated with Australian experience and summarised for the benefit of livestock owners.

Beef Cattle.—Pasture fattening is the accepted method of preparing beef cattle for market. It appears likely that the fattening of some ''chiller grade'' steers on compartively small properties will become more general. This will involve the use of some concentrates and possibly silage. Corn-in-cob is the most economical method of feeding maize to ''top off'' steers.

Sheep.—Merinos, which represent the majority of Queensland's sheep population, are only fed with concentrates in times of stress. Fortunately sheep are extremely thorough masticators, and it is only with very hard grain that crushing is necessary.

With the cross breeds, or meat breeds, it rarely pays to prepare the food. An exception may be made of lucerne hay, which sheds its leaves readily and consequently involves a loss due to the selective feeding of the animal. It therefore pays to chaff lucerne hay so that a proper admixture of stem and leaf is assured and waste avoided.

Concentrates in compressed ''cube'' or ''nut'' form are often fed to sheep, and may be swallowed whole. They are rapidly disintegrated under the action of digestive juices, so that there is no need to treat them in any way.

Horses.—There is no need to prepare oats or corn in any way, but harder grain should be crushed. Soaking is rarely justified and only when soaking of very hard grain is cheaper than crushing.

Roughage may be chaffed for hard worked horses, stud animals, or animals being prepared for exhibition. It is quite unnecessary for idle horses.

Very fine foods are to be avoided. Milling by-products should be carefully incorporated in the bulky feed, and if dusty a little water—preferably sweetened with molasses—may be added.

When the Cart is Bogged.

One of the common experiences of farm life is to be bogged with a cart or dray, down perhaps to the axle. This is how to get over the difficulty. Take off the leader and hook him on to the wheel that is bogged. A chain, or some wire doubled and put round the spoke and over the tyre, fixed far enough back to give a good pull, is sufficient for the job. Tie well back past the top of the wheel, about three-quarters of the way up the other side, so that the first strain will be at such an angle as to pull forward without any chance of slipping. Stand the team up to a pull together, and this will give all the extra purchase needed to lift the wheel clear. If the wheel should happen to slip, tie a piece of wood to the bottom of the wheel or strap a piece of timber to a spoke to act as a grip to lever against.

Fat Lamb Production.

Gratifying results have followed the scheme initiated by the Minister for Agriculture and Stock with the object of stimulating the production of fat lambs. Rams of British breeds, comprising Border Leicesters, South Downs, Dorset Horns, Shropshires, and Romney Marsh, were purchased in the South and distributed to farmers who had cultivation available, or who were prepared to cultivate. In certain cases in which a farmer owned a stud ram of a particular breed, stud ewes were supplied with the idea of fostering the breeding of pure stock. All sheep supplied to farmers are on loan, and remain the property of the Department. The progeny and wool, however, become the property of the farmers concerned.

The greatest drawback to the production of fat lambs on the Darling Downs in quantity has been, and still is, the difficulty of purchasing good crossbred ewes as the mother flock.

If a start has to be made with merinos the best ewe for fat lamb raising is bred by the introduction of one of the long wools, such as Border Leicester, Lincoln or Romney Marsh, into the strong-woolled, robust type of merino ewe. The ewe lambs of this drop should then be retained as the future dams of the lamb-raising flock.

As to suitable ewes for the fat-lamb industry, it is believed that graziers on the fringe of the Darling Downs or further out would find it profitable to join long-woolled rams of British breed with their cast-for-age ewes with the idea of selling the progeny annually as fat lamb ewes on the Downs. Into the crossbred ewe flock, as described, should be introduced a ram of the Downs type. Opinions necessarily differ in the matter of crosses. The South Down is the fashionable lamb at the present time, but it should be remembered that this cross must suffer no check from birth to block. The Dorset Horn gives a very nice lamb, early maturing and hardy. The use of the Border Leicester should be encouraged in every way. In addition to producing an early-maturing lamb that fills every want, it must be remembered that the skin value of this lamb is worthy of consideration to a far greater extent than either the Dorset or the South Down.

Purebred Corriedale ewes are hard to come by, but should the opportunity occur a farmer would be well advised not to let it slip. Pure Corriedales are hard to beat, good mothers and heavy milkers, besides growing a profitable fleece.

Generally, the wool from a flock retained for fat lamb breeding is a secondary consideration when compared with the production of fat lambs.

The Handling of Small Clips.

It is always a problem for the farmer who is running a few sheep to get full value for the wool he cuts. Hence the service given to farmers by the Department of Agriculture and Stock through the farmers' wool scheme. Should the number of sheep depastured enable a farmer to prepare correctly the bulk of his wool for market, he is advised to do so. Star lots and oddments should then be sent to the Department for classification, with the object of getting full market values.

An advance of 60 per cent., free of interest, of the estimated value of the wool, is made by the Department to growers running less than 1,500 sheep. In the meantime, the wools received are classed into large lots, where that is possible, thus meeting with full competition when placed on the market.

Should the bulk of the clip be prepared for market on the property, it is necessary that all fleeces should be carefully skirted and all stains removed. The classification of the fleeces calls for special knowledge and, if the farmer is not capable of doing it himself, he should employ a man competent for the work. A few pounds spent in the proper get-up of a clip may be regarded as economy, the farmer being more than recompensed for the outlay by the enhanced prices received.

If the farmer has insufficient sheep to make the services of a classer worth while, the Department is prepared to make the services of an officer available for instructional purposes on the property.

Lifting Pigs.

Sometimes a farmer has three or four pigs to be sent away on a lorry and has no loading race, thus making it awkward to load them. One man stands on the left and holds the pig's ear with his left hand while another stands on the right and holds the pig's tail with his left hand. Both must then grasp hands under the pig's chest near the front legs, and it is then an easy job to lift it into the lorry.

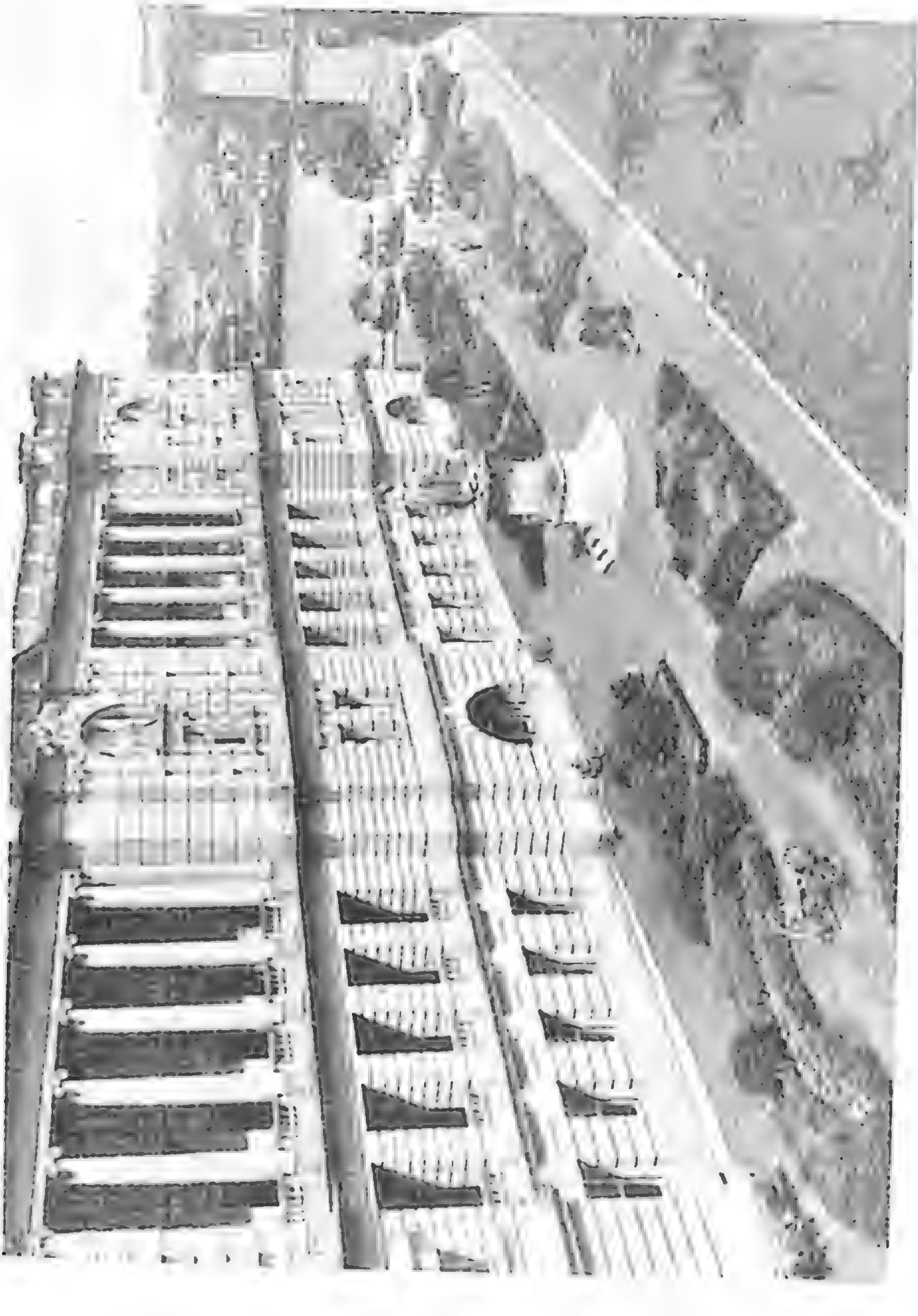


Plate 91.

A View of Queen's Gardens, Brisbane.

Showing the Executive Building and a glimpse of the Brisbane River beyond. The flower beds supply a blaze of gorgeous colouring the whole year round.

Orchard Notes

SEPTEMBER.

THE COASTAL DISTRICTS.

IN the North Coast and Gayndah districts the bulk of the citrus crops have been harvested with, perhaps, the exception of Valencia Lates. Orchard activities should be directed towards pruning, cultivation, fertilizing, and spraying. As a result of seasonal conditions there are numerous instances of trees showing signs of impaired vigour, and these will require a severe pruning both in thinning and shortening back, removing superfluous growths and diseased and weakly woods. Healthy and vigorous orange trees will require little attention beyond the removal of crowded lateral growths.

Mandarins will need special treatment, particularly Glen Retreats and Scarlets. These varieties usually produce a profusion of branches, and as the trees mature the growths harden and the fruit-bearing shoots make short, weakly growths, which generally results in an over-production of small fruits and a weakening of the trees. This is particularly noticeable in the case of the former variety. Here the annual pruning should consist of a heavy thinning and shortening back. Mature mandarin trees require attention towards assisting them to produce new and vigorous fruit-bearing growths.

Unprofitable trees should receive attention and be prepared for top-working. They may be headed back to three or four main arms radiating from the stem and whitewashed to prevent bark scald. Such trees may be grafted or later budded when suitable growths have matured.

Prior to working up the soil fertilizing should receive attention. The spring application should carry a high percentage of nitrogen.

In the warmer districts which are free from frosts plantings of young trees may be made. Serious consideration should be given to the selection of commercial varieties only, and, having due regard for local conditions, selections may be made from the following varieties:—Washington, Navel, Joppa, Siletta, Valencia Late, Beauty of Glen Retreat, Emperor, Scarlet, Solid Scarlet, Marsh Seedless or Thompson grapefruit, and Villa Franca, Lisbon, and Genoa lemons.

Where Melanose and Black Spot are present in orchards preparations for control measures should be made, and Bordeaux sprays applied at the correct times.

The majority of citrus trees would be considerably benefited by the application of a strong lime-sulphur wash, 1-18.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

BLACK aphis should be fought wherever it makes its appearance by spraying with a tobacco wash, such as black-leaf forty, as if these very destructive insects are kept well in hand the young growth of flowers, leaves, wood, and fruit will have a chance to develop.

The working over of undesirable varieties of fruit trees can be continued. The pruning of grape vines should be done during the month, delaying the work as long as it is safe to do so, as the later the vines are pruned the less chance there is of their young growth being killed by late frosts. Keep the orchards well worked and free from weeds of all kinds, as the latter not only deplete the soil of moisture but also act as a harbourage for many serious pests, such as the Rutherglen bug.

New vineyards can be set out, and, in order to destroy any fungus spores that may be attached to the cuttings, it is a good plan to dip them in Bordeaux mixture before planting. The land for vines should be well and deeply worked, and the cutting should be planted with one eye only out of the ground and one eye at or near the surface of the ground.

In the warmer parts which are suitable for the growth of citrus fruits, the land must be kept well cultivated, and if the trees need irrigating they should be given a good soaking, to be followed by cultivation as soon as the land will carry a horse without packing.

In these parts fruit fly should be systematically fought, as it will probably make its appearance in late citrus fruits and loquats; and if this crop of flies is destroyed, there will be every chance of the early crops of plums, peaches, and apricots escaping without much loss.

Plate 92.

Daggs Falls, near the Spring Creek Road, at Killarney.

Farm Notes

SEPTEMBER.

WITH the advent of spring, cultivating implements play an important part in farming operations.

The increased warmth of soil and atmosphere is conducive to the growth of weeds of all kinds, particularly on those soils that have only received an indifferent preparation.

Potatoes planted during last month will have made their appearance above the soil, and where doubt exists as to their freedom from blight they should be sprayed with either Burgundy or Bordeaux mixture as soon as the young leaves are clear of the soil surface.

Land which has received careful initial cultivation and has a sufficiency of sub-surface moisture to permit of a satisfactory germination of seeds may be sown with maize, millets, panicum, sorghum, melons, pumpkins, cowpeas, broom millets, and crops of a like nature, provided, of course that the areas sown are not usually subjected to late frosts.

Rhodes grass may be sown now over well-prepared surfaces of recently cleared forest lands or where early scrub burns have been obtained, and the seed is sown subsequent to showers. More rapid growths, however, are usually obtainable on areas dealt with, say, a month later.

In connection with the sowing of Rhodes grass, farmers are reminded that they have the Pure Seeds Act for their protection, and in Rhodes grass, perhaps more than any other grass, it is necessary that seed of good germination only should be sown. A sample forwarded to the Department of Agriculture will elicit the information free of cost as to whether it is worth sowing or not.

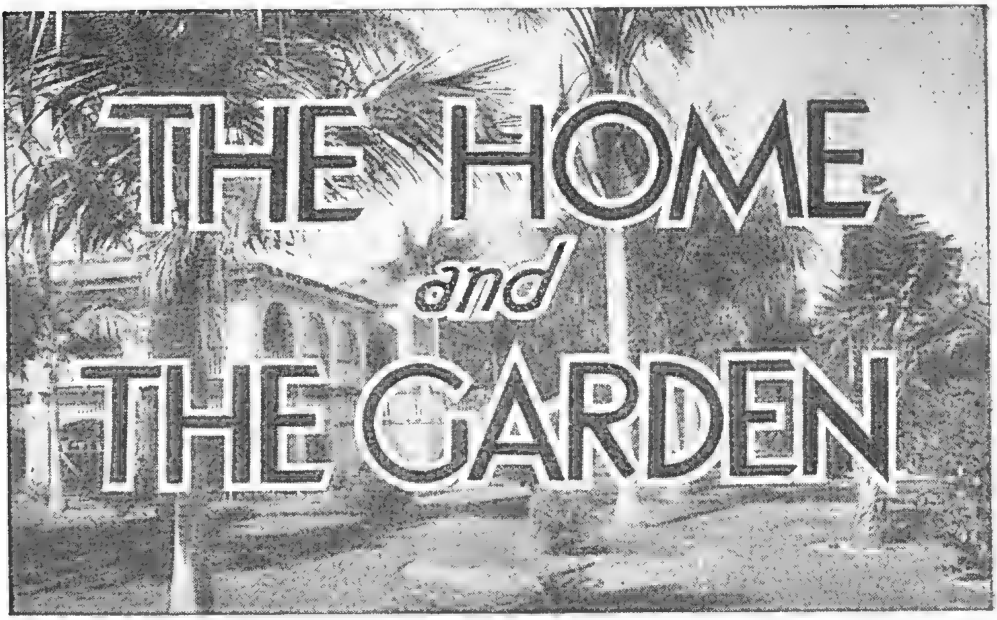
Where the conditions of rainfall are suited to its growth, paspalum may be sown this month.

The spring maize crop, always a risky one, requires to be sown on land which has received good initial cultivation and has reserves of soil moisture. Early maturing varieties so-called "90 Day," are preferable for spring sowings, as they will make the best use of the moderate rains usually received during the early summer months. Inter-row cultivation is important, checking weed growth and maintaining the surface soil in a friable condition.

Although cotton may be sown this month, it usually stands a better chance if deferred until October, when the warmer temperatures allow of the obtaining of better germination and promote a healthier growth of the resultant seedlings. The harvesting of cotton during the normal rainy season is, if possible, to be avoided.

The sowing of intermediate crops prior to the preparation of land for lucerne sowing should be carried out in order that early and thorough cultivation can take place prior to the autumn sowing.

The following subsidiary crops may be sown during the month:—Peanuts, sweet potatoes, arrowroot, cow cane, and in those districts suited to their production yams and ginger. Plant out coffee.



OUR BABIES.

Under this heading a series of short articles, by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

REST AND SLEEP.

THE newborn baby normally sleeps nine-tenths of its time, and at six months two-thirds of its time. The baby should be trained to sleep at the same time every day and all night. The habit of sleeping peacefully is one of the clearest evidences of sound health. Normal, healthy babies should be trained from the beginning to have no night feeding. This ensures an undisturbed night's rest to the mother, and establishes the baby in his proper rhythm from the start, saving him from the period of irritability, disturbed rest, and slackening of growth incidental to the breaking of a bad habit a few months later. Why break in on the night's rest? Why impart any tendency to insomnia at the start of life? Happy is the baby who sleeps all night from the dawn of existence.

It is well to continue the morning rest until the child is three or four years old, especially during summer, when children wake early. Even if the child does not sleep, the habit of resting is of great value. A short rest, or sleep, restores a child wonderfully, and the result is that there is no crossness or fatigue at the end of the day.

In forming good habits of rest and sleep, regularity is necessary. Do not pick the baby up when he cries at night. However, the mother should make sure that the baby is quite dry; that he is not suffering from wind; and is quite snug and comfortable. It is possible to change the baby's napkin without waking him.

The baby should be trained as soon as possible to sleep during the hours when the mother is busiest with her household duties. He will then take a long sleep during the morning, stay awake for an hour or two, and take a long nap in the early afternoon. As baby grows older he should not be encouraged to have a long sleep in the late afternoon, as he then will not be ready to go to sleep after the evening meal (5.30 to 6 p.m.). A late afternoon sleep also interferes with the early afternoon outing. It would be a great advantage to the entire household, apart from the health and benefit accruing to the child, if young mothers would contrive to have the baby and younger children asleep in bed before the father arrives home for the evening meal. Never play with and excite a baby just before bedtime. While natural mothering and moderate handling is beneficial, injudicious or excessive handling or stimulation is highly injurious.

OVERSTRAINED BABIES SLEEP BADLY.

Children are fond of babies and never tire of stimulating their funny performances. This should not be permitted. Unfortunately, some parents and friends are just as foolish in amusing themselves at the expense of the baby. A little gentle stimulation by the mother may be harmless, and even beneficial, to some babies. Continual stimulation (especially before bedtime) spoils their sleep, upsets their nutrition, and makes them nervous and irritable. This is giving them a very bad start in life, and may have undesirable consequences in the future.

Some parents are in the habit of taking their children, and even their babies, out with them in the evening, shopping or visiting. In some instances there is no one with whom they can be left, but baby's welfare should always be considered first. It is worse still to take them to the cinemas, where they become overtired or over-excited, and are exposed to the great risks of infection with influenza, catarrhs, and other diseases, leading perhaps to pneumonia or abscess in the ears.

HOW MUCH TO EAT.

(Contributed by the Queensland Nutrition Council).

"LIVE to eat!" or "Eat to live!"—which shall it be? As is the case with so many vexed questions, neither extreme is correct. Would you call normal the man who gulps down a few mouthfuls of food placed before him by an insistant wife, with no thought for its delicacy or method of serving? Do you, on the other hand, really envy the man who turns every meal into a feast, rising with disappointment, and some difficulty, when the last available particle has disappeared, to seek in repose an opportunity for overworked nature to catch up in the eternal competition? Most assuredly you do not envy either of these extreme individuals. "Moderation in all things and all things in moderation," should be one's motto in eating, as in all the necessities and pleasures of life.

The Appetite.

Scientists will tell you that hunger is accompanied by contractions of the muscular stomach wall, and that these contractions are associated with the secretion of adrenalin from one of the ductless glands. This in turn may be due to a falling level of sugar in the blood. The whole mechanism is very complicated, and appetite is not exactly the same as hunger. Every normal person should experience appetite, but only the starved person, should feel real hunger.

We all know what appetite is and the normal variations to be expected, though they are difficult to define. Appetite may become abnormal in three ways—(i.) lessened (ii.) increased (iii.) perverted. It should be the aim of every person to keep the appetite within normal limits by neither denying nor satiating it. If, in spite of this reasonable behaviour, it persists in being abnormal, there must be a cause, and the cause must be found. The person to do that is your doctor.

The chief causes of lessened appetite are:—

Worry.—A very common cause, especially in women, but also in men.

Irregular eating as indulged in by the housewife who "picks" between meals, the school-child spending his pennies on sweets, and the busy man who "just cannot be bothered."

General loss of condition from overwork, lack of exercise, loss of sleep, etc.

Ill-balanced diet.—Diet which continues to contain a deficiency of some necessary item (especially vitamin B) very often leads to a loss of appetite.

Gastric abuse.—The continued use of food or drink irritating to the stomach, e.g., chronic over-indulgence in alcohol, will impair the appetite.

Gastric diseases of various kinds affect the appetite. If there is any reason to suspect these, the doctor should have the earliest opportunity of finding this out.

General disease, even a cold will impair the appetite. In such cases it is not wise to force it too enthusiastically.

The way to correct diminished appetite is not to force unwelcome food in blank defiance of the body's desires, but to set about finding out why the appetite is poor. *One should examine one's eating habits candidly and firmly.* Only too often the habits are entirely at fault. The importance of doing this early is not merely the restoration of a pleasant bodily function but the prevention of actual digestive disease. Loss of appetite, "indigestion," distaste for food are often friendly warnings that the digestive apparatus is being ill-treated. If they are ignored, actual disease frequently develops. If there is any doubt at all on the matter, particularly if no fault can honestly be found with the eating habits of the individual, a medical man should be consulted, especially if the sufferer is getting on in life.

Increased Appetite.

A definitely increased appetite occurs in some diseases such as exophthalmic goitre and diabetes. Apart from this, however, many people feel that they ought to eat much more than they really need.

This is particularly so with sedentary workers at or past middle age. As that indefinite though real period known as "the prime of life" is passed, creature comforts come to appeal more and more; the spartan recklessness of youth dies away and pleasurable indulgence appears to be more man's desire. Of those comforts, eating is one of the foremost. Coupled with this development is often a growing disinclination for active exercise. True, golf, bowls and other pastimes are designed to supply this exercise, but they are poor substitutes for the spontaneous activity of youth. Thus it is that those who have never been worried by the lack of appetite become a prey to the insidious fault of over-eating in middle age. For such as these, moderation is more than a motto, it is a necessity.

In advocating moderation or a restriction of food for middle-aged people of sedentary habit, there is no desire to condone neglect of eating or to close one's eyes to the undesirability of a poor appetite, any more than in earlier life. The moderation which is practised should be an all-round restraint and not the faddist's exclusion of a particular food. Modern science knows no reason why "red" meats should be prohibited while "white" meats should be permitted. Modern science knows no reason why proteins and carbohydrates should be regarded as incompatible, and excluded from the privilege of combining in a meal. Modern science *does* realize, however, that most people, and especially those of the earlier generations, eat far too little of such foods as fruit, milk, and vegetables. For that reason it is suggested that the restriction of the "over 40" diet should commence with the other articles of diet, especially those containing a preponderance of the highly-refined foods.

Effects of Over-eating.

Over-indulgence in almost any form (including over-indulgence in work) is one of the predisposing causes of high blood pressure. Over-eating is an important factor in the causation of diabetes, gout and other kindred disorders. Even if these definite diseases are not developed (because other things than over-eating must be acting), a state of impaired health and decreased efficiency must result. The tendency to drop off to sleep after lunch is sometimes due to this. A certain laxity of mind is normal after a meal, but drowsiness is abnormal. Increasing girth in middle age is partly due to over-eating, although other factors enter in here, such as the balance of the ductless glands and loss of muscular tone. Digestive disorders are certainly encouraged by eating too much, especially too much of the highly refined foods.

Slimming.

To reduce weight is a modern fad. For people who become overweight by reason of obvious over-eating, a reduction of food and a consequent reduction of weight is reasonable enough. Apart from this, however, especially in younger people, slimming is a bad and often dangerous practice. People are not all cast in the same mould—thank goodness! There are people who, for one reason or another, remain slim and are perfectly healthy. For those people to fatten up, a change in

their make-up or definite over-eating would be necessary. Similarly, there are naturally stout people, and for these to "slim" necessitates a process of starvation. Many are the disasters to be attributed to this bad practice, not the least of which is predisposition to tuberculosis. There is one rule which these people who wish to reduce might bear in mind—the minimum amount of weight for a given diet is gained if the diet is perfectly balanced. A maintenance diet, perfectly balanced, is the minimum amount of food that can be taken with safety.

Dietary Rules.

1. If your appetite is normal, treasure it and do not abuse it by neglect or by gorging. Avoid conditions which might interfere with your digestion.

2. If your appetite is poor, examine your eating habits carefully and put them right. If the appetite is still poor, consult a medical man.

3. If you are at all worried about your appetite, consult your doctor.

4. If you are past middle age, and engaged in sedentary work, ask yourself frankly if you are eating too much. If so, reduce the quantity a little and see if you feel any better for it.

5. Do not be misled by single idea enthusiasts. There is no royal road to health, there is only a guiding principle—moderation!

6. It is safer to be over-weight under thirty-five and under-weight over thirty-five.

Plate 93.

JACQUELINE.—A little Queenslander of the cattle country of the South-West.

IN THE FARM KITCHEN.

CURRIES FOR COLD DAYS.

A Simple Curry.

Take ½ small apple, ¼ onion, 1 oz. margarine, 1 teaspoonful curry-powder, 1 teaspoonful curry-paste, 1 dessertspoonful flour, ¾ pint stock, 1 tablespoonful coconut, ¾ lb. cooked meat, 3 oz. boiled rice, chutney.

Place the coconut in the stock and allow it to soak. Chop the apple and onion finely, and fry in the margarine till slightly browned. Add the curry paste and powder. Strain off the coconut and add the stock, then simmer gently from thirty to forty-five minutes, then add the meat cut into dice. Blend the flour to a smooth paste and add it to the mixture. Stir till boiling, place the lid on the saucepan, and keep under boiling point from ten to fifteen minutes. Dish inside a border of boiled rice. Serve with chutney.

Curried Mushrooms.

Take ½ lb. small mushrooms, 1 hard-boiled egg, 1 dessertspoonful curry-powder, ½ oz. flour, 1 oz. butter, juice ½ lemon, 1 gill milk, ½ onion, salt, 3 oz. rice.

Peel and wash the mushrooms, and remove the stalks. Chop the onion and egg. Fry the onion and mushrooms gently in the butter for five minutes. Put the mushrooms on a plate. Mix the curry-powder and flour with the butter and fried onion and add the milk gradually. Stir it till it boils, and add the egg, salt, and lemon juice. Place the mushrooms in a double saucepan and pour the sauce on to them, leaving them for thirty minutes or till tender. Wash the rice and boil it for fifteen minutes in fast-boiling water. To serve, heap the rice in the middle of a hot dish with the mushrooms round it.

Farmhouse Curry.

Take 1 dessertspoonful curry-powder, ½ pint stock or water, ½ lb. cold meat, 1 dessertspoonful flour, 1 tablespoonful apple chutney, 2 tablespoonfuls cream, salt, 1 onion, 1 apple, milk, 1 oz. dripping, lemon juice, boiled rice.

Chop the meat, removing all gristle. Melt dripping, and when smoking hot fry onion, flour, and curry-powder together for a few moments, stirring all the time. Add chopped apple, salt, and stock or water. Stir carefully till sauce is smooth and boiling, then simmer for half an hour. Add meat, thin with milk, add chutney, and bring again to the boil. Just before serving, stir in a few drops of lemon juice, then cream, and serve surrounded with boiled rice.

Curried Lamb Casserole.

Take 1¼ lb. neck of lamb, 1 teaspoonful curry-powder, 1 teaspoonful flour, ½ lb. carrots, seasoning, 4 small onions, ½ lb. potatoes (new if possible), cold water.

Scrape or peel potatoes, scrape carrots, and boil in salted water till tender. Peel the onions and boil till tender separately. Drain the vegetables, cut potatoes and onions in half, and slice the carrots. Simmer the meat till tender in boiling water. Remove from the pan and cut into pieces. Mix the curry-powder and flour to a paste with a little cold water and add about three-quarters of a pint of the liquor the meat was boiled in. Mix till smooth and add seasoning. Put the meat and vegetables in a casserole. Pour the curried stock over. Cover and bake in a fairly hot oven for half an hour.

Curried Bananas.

Take 3 oz. rice, 4 bananas, ½ oz. margarine, ½ oz. flour, ½ apple, ½ onion, 1 teaspoonful curry-powder, 1½ gills water, juice ½ lemon, 2 hard-boiled eggs, 1 teaspoonful salt.

Wash the rice and boil it for fifteen minutes with the salt in plenty of fast-boiling water. Boil the eggs for ten minutes, put them in cold water, and remove the shells.

To make the curry sauce, peel and chop the apple and onion, and fry them in the margarine for five minutes. Stir in the flour, curry-powder, lemon juice, and a pinch of salt, and add the water gradually. Stir the sauce till it boils, lay the skinned bananas in the sauce and heat them for about five minutes. Add a little more water if necessary. Strain the rice into a colander and grate the onion on to it. Do not mash the rice. If it is boiled for exactly the right time each grain will be separate. Heap the rice on a hot dish with the bananas and sauce round, and garnish with quarters of hard-boiled egg.

Bengal Curry.

Take 1 oz. butter or margarine, 1 small onion, 1 dessertspoonful curry-powder, ¼ to ½ pint milk, ½ lb. rice, ½ lb. uncooked or any left-over meat will do.

Cut the onion into slices and put into a saucepan with the butter. Fry until browned, then add the curry-powder and mix well. Pour in the milk and mix thoroughly with the curry. Cut the meat into pieces about an inch square, add to the saucepan, and allow to simmer for about twenty minutes. Turn into a flat dish and serve with a border of boiled rice, piping hot.

Note: Be sure to fry the curry-powder well in butter or margarine before the liquid is added, which turns it into a sauce. Then simmer until all the ingredients are well mixed.

Curried Vegetable Patties.

Take 1 cupful of any cold vegetables, 1 oz. sultanas, 1 onion, ½ oz. flour, 1 gill water, ½ gill vinegar, ½ oz. curry-powder, ¼ teaspoonful salt, parsley, 3 or 4 slices stale bread about two inches thick, ¾ oz. butter, deep frying fat.

Mince the onion and fry it in the butter for five minutes. Stir in the flour, curry-powder, and vinegar. Add the water and sultanas and stir till boiling. Season to taste. Chop the cold vegetables and add them to the sauce. Keep them hot on a very low gas while making the fried bread-cases.

To make the cases, cut the bread into rounds and scoop out the centre. Fry one at a time in smoking hot fat for about three minutes, turning them over when one side is done. They should be a golden brown. Drain them on paper and fill with the hot vegetable mixture. Serve on a lace paper and garnish with parsley.

Madras Curry.

Take 1 good-sized onion, 4 oz. desiccated coconut, ½ oz. butter, 1 dessertspoonful curry-powder, ½ apple, a strip of lemon-peel, 2 or 3 cloves, 6 oz. rice, ½ lb. lean uncooked meat.

Pour a large teacupful of boiling water over the grated coconut, allow to stand for a little while, then strain off the milk and set by. Cut the onion into slices and fry in the butter until browned. Fry the curry-powder, and add half the coconut milk, mixing all well together. Add half of an apple, peeled and cut into slices, a strip of lemon-peel (this should be taken out when served), and two or three cloves. Cut the meat into small pieces, stir into the mixture, and allow to simmer for about two hours. Before serving add the remainder of coconut milk. Turn on to a flat dish and serve with a border of boiled rice.

THE DIPPING OF CATTLE.

The dipping of cattle is sometimes treated casually in tick-infested areas and this is not infrequently the cause of an unsatisfactory clean up, and also of ill effects on the stock such as scalding.

Cattle should be quietly driven to the dip and allowed to cool down in the yard before they are passed through the dipping fluid. "Rushing" is both unnecessary and undesirable. Cattle often tend to race back to the farm after treatment, but they should always be steadied down to a moderate pace.

Dairy cows are particularly susceptible to scald in the udder, and injuries of this type frequently lead to difficulties in milking. Scalding is often attributed to too strong a dipping fluid; but the real trouble is more often the failure of the farmer to grease the sensitive parts of the udder before the cows leave the farm for the dip.

All the ticks may not be killed at one treatment, even when the dipping fluid is of standard strength. Ticks in the process of moulting may survive while travelling stock sometimes accumulate sufficient dirt and grime in the heavy winter coat to protect some of the more sheltered pests. Nevertheless, where reinfestation is not heavy, properly tended cattle should not be troubled by ticks for some time after dipping and the farmer cannot afford to neglect the only known method of coping with the pest.

J. Gunn, Stock Branch.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

Table showing the Average Rainfall for the Month of June, in the Agricultural Districts, together with Total Rainfall during 1937 and 1936, for Comparison.

Divisions and stations.	Average Rainfall.		Total Rainfall.	
	June.	No. of years' records.	June, 1937.	June, 1936.
North Coast.	In.		In.	In.
Atherton	1·69	36	0·25	3·96
Cairns	2·90	55	0·30	8·12
Cardwell	2·04	65	0·83	2·82
Cooktown ..	*2·02	61	0·03	4·29
Herberton ..	1·17	51	0·07	2·68
Ingham	2·41	45	1·51	4·50
Innisfail	7·28	56	3·19	13·64
Mossman Mill ..	2·53	24	0·70	9·56
Townsville ..	1·38	66	0·75	4·90
Central Coast.				
Ayr	1·50	50	0·48	5·37
Bowen	1·65	66	1·54	5·66
Charters Towers ..	1·32	55	1·90	5·23
Mackay	2·74	66	1·88	10·31
Proserpine ..	3·41	34	1·56	11·44
St. Lawrence ..	2·51	66	1·40	6·39
South Coast.				
Biggenden ..	2·25	38	0·92	5·48
Bundaberg ..	2·88	54	1·26	5·23
Brisbane	2·71	85	0·73	1·90
Caboolture ..	2·68	50	1·14	2·17
Childers	2·49	42	0·79	3·90
Crohamhurst ..	4·48	44	1·74	4·57
Esk	2·22	50	1·16	2·02
Gayndah	1·83	66	0·72	3·67
Gympie	2·68	67	1·21	3·65
Kilkivan	2·12	58	1·16	3·47
Maryborough ..	3·02	66	1·63	4·61
Nambour	3·75	41	1·94	4·86
Nanango	1·98	55	1·29	2·13
Rockhampton ..	2·59	66	1·60	4·67
Woodford	2·89	50	1·51	2·57
Central Highlands.	In.		In.	In.
Clermont ..	1·68	66	1·70	2·51
Gindie	1·45	38	..	1·63
Springsure ..	1·77	68	0·92	1·91
Darling Downs.				
Dalby	1·67	67	1·04	1·56
Emu Vale ..	1·50	41	0·78	1·27
Hermitage ..	1·75	31	..	1·82
Jimbour ..	1·65	49	0·79	0·79
Miles	1·77	52	0·68	1·29
Stanthorpe ..	1·90	64	1·33	1·27
Toowoomba ..	2·38	65	1·19	1·64
Warwick ..	1·74	72	0·68	1·68
Maranoa.				
Roma	1·57	63	0·50	1·29
State Farms, &c.				
Bungeworgorai ..	1·30	22	..	1·26
Gatton College ..	1·82	38	0·82	1·96
Kairi	1·46	21	..	..
Mackay Sugar Experiment Station	2·50	40	1·57	9·90

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JUNE, 1937.

Compiled from Telegraphic Reports.

Districts and Stations.	Mean Atmospheric Pressure. at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·95	78	66	85	4	54	25	3	1
Herberton	..	73	49	80	14, 15	32	21, 23	7	4
Rockhampton	30·06	72	52	83	13	41	3	160	5
Brisbane	30·07	67	51	71	13	43	30	73	8
Darling Downs.									
Dalby	30·10	64	40	72	9, 10	27	2	104	9
Stanthorpe	..	57	34	65	10	18	3	133	13
Toowoomba	..	60	41	66	13	24	17	119	6
Mid-Interior.									
Georgetown	30·00	81	51	90	13	34	21	Nil	..
Longreach	30·10	71	43	80	9	34	2	79	5
Mitchell	30·13	65	36	74	10	23	2	110	4
Western									
Burketown	30·02	80	55	89	14	44	22	Nil	..
Boulia	30·12	70	46	77	13	40	2, 3, 6, 7, 27, 28	89	2
Thargomindah	30·12	64	41	75	9	29	2	51	3

ASTRONOMICAL DATA FOR QUEENSLAND.

Times Computed by A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	August. 1937.		September. 1937.		MOONRISE. Aug. 1937.	MOONRISE. Sept. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
1	6.35	5·21	6·7	5·37	a.m. 1·4	a.m. 2·56
2	6·34	5·22	6·6	5·37	2·8	3·45
3	6·33	5·23	6·5	5·38	3·11	4·27
4	6·33	5·24	6·4	5·38	4·9	5·6
5	6·32	5·25	6·3	5·39	5·2	5·43
6	6·31	5·25	6·2	5·39	5·51	6·19
7	6·31	5·26	6·1	5·40	6·33	6.54
8	6·30	5·26	5·58	5·40	7 11	7·29
9	6·29	5·27	5·57	5·41	7·47	8·6
10	6·28	5·27	5·56	5·41	8·22	8·46
11	6·28	5·28	5·55	5·42	8·56	9·26
12	6·27	5·28	5·53	5·42	9·32	10·10
13	6·26	5·29	5.52	5·43	10.9	10·59
14	6·25	5·29	5·51	5·43	10·50	11·51
15	6·24	5·30	5·50	5·44	11·31	p.m. 12·46
16	6·23	5·30	5·49	5·44	p.m. 12·17	1·40
17	6·22	5·31	5·48	5.45	1.7	2·37
18	6·21	5·31	5·47	5·45	2·0	3·36
19	6·20	5·32	5·45	5·45	2·56	4·35
20	6·19	5·32	5·44	5·46	3·52	5·34
21	6·18	5·33	5·43	5·46	4·49	6 36
22	6·18	5·33	5.42	5·47	5·49	7·36
23	6·17	5·33	5·41	5·47	6·48	8 48
24	6·16	5·34	5·40	5·47	7·48	9·54
25	6·15	5·34	5·39	5·48	8·48	10·56
26	6·14	5·35	5·38	5·48	9·52	11·58
27	6·13	5·35	5·37	5·49	10.56	—
28	6·12	5·36	5.36	5·49	..	a.m. 12·52
29	6·11	5·36	5·35	5·50	p.m. 12·2	1·40
30	6·10	5·37	5·34	5·50	1·4	2·24
31	6·9	5·37			2·3	

Phases of the Moon, Occultations, &c.

6 Aug.	● New Moon	10 37 a.m.
14 ,,	☾ First Quarter	12 28 a.m.
22 ,,	○ Full Moon	10 47 a.m
29 ,,	☽ Last Quarter	9 55 a.m.

Perigee, 3rd August, at 2 p.m.
Apogee, 15th August, at 1 p.m.
Perigee, 29th August, at 1 p.m.

On the morning of the 4th Venus, the beautiful Morning star, will be seen near the waning Moon.

Mars, whose movements have been watched with interest for some months will on the 15th again be in the head of the Scorpion as at the beginning of April. On its journey eastward through the narrow part of Orphincus it will pass the brightest stars in Scorpion.

Jupiter, the most brilliant object in the evening sky, appears high in the east after sunset. Apparently moving westward it will on the 28th be near the brightest stars in Sagittarius. It is now more than two million miles nearer the Earth than it was in the middle of July when, at its nearest, a distance of nearly 600 million miles separated us from the giant planet.

Saturn, rising about 9.30 p.m. at the beginning of the month and about two hours earlier at the end, will be found almost in line with the two stars forming the eastern side of the Great Square of Pegasus.

Mercury rises at 7.49 a.m., 1 hr. 14 min. after the Sun and sets at 7.1 p.m., 1 hr. 40 min. after it on the 1st; on the 15th it rises at 7.41 a.m., 1 hr. 40 min. after the Sun and sets at 7.35 p.m., 2 hr. 5 min. after it.

Venus rises at 3.40 a.m., 2hr. 55 min. before the Sun and sets at 2.14 p.m., 3 hr. 7 min. before it on the 1st; on the 15th it rises at 3.52 a.m., 2 hr. 32 min. before the Sun and sets at 2.28 p.m., 3 hr. 2 min. before it.

Mars rises at 12.1 p.m. and sets at 1.39 a.m. on the 1st; on the 15th it rises at 11.28 p.m. and sets at 1.16 a.m.

Jupiter rises at 3.53 p.m. and sets at 5.33 a.m. on the 1st; on the 15th it rises at 2.50 p.m. and sets at 4.36 a.m.

Saturn rises at 9.33 p.m. and sets at 9.41 a.m. on the 1st; on the 15th it rises at 8.35 p.m. and sets at 8.14 a.m.

The Southern Cross will be on its downward path towards the west, accompanied by two of the finest constellations, the Centaur and Argo, the Ship; but in the north-east the Northern Cross has arisen, part of the constellation Cygnus, the Swan, which with outstretched wings is flying upwards.

5th Sept.	● New Moon	8 54 a.m.
13th ,,	☽ First Quarter	6 57 a.m.
20th ,,	○ Full Moon	9 32 p.m.
27th ,,	☾ Last Quarter	3 43 p.m.

Apogee, 12th September, at 8 a.m.
Perigee, 24th September, at 7 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling**, members of Agricultural Societies, **Five Shillings**, including postage. General Public, **Ten Shillings, including postage.**

VOL. XLVIII. 1 SEPTEMBER, 1937. PART 3

Event and Comment

The Australian Agricultural Council.

AMONG the outstanding events of the month was the meeting in Brisbane of the Australian Agricultural Council, which was attended by the Commonwealth Minister for Commerce and the Ministers for Agriculture of every State. The conference was the most important held since the Council was constituted several years ago. Reviewing its decisions, the Queensland Minister, Hon. Frank W. Bulcock, said that the motive underlying the formation of the council had been the unification of research and the provision of a common approach to economic and agricultural problems.

Three of the decisions were of outstanding interest. The council affirmed that water conservation was a national and not a State matter, and that the necessary inquiry should be made to elevate this question to one involving the co-operation of all the Governments. Allied to this was the problem of fodder conservation, which naturally would follow a sound water policy.

Secondly, the council affirmed its opposition to quotas and to the restriction of production, and expressed a desire that its opinion as the highest deliberative agricultural body in Australia should be sent to the appropriate authorities.

In the third place it declared for co-ordination of research services in relation to stock diseases, and made provision for summoning departmental representatives of the States to lay down a programme for disease prevention and eradication, with special reference to contagious disorders.

The Queensland Council of Agriculture.

ANOTHER important event in August was the annual conference of the Queensland Council of Agriculture, the executive body of the Queensland Producers' Association. The President, Hon. Frank W. Bulcock, in opening the conference, said that economic security was one of the fundamentals of rural organisation. "I am speaking," he continued, "to the farmers of the State through their farmers' parliament. If the farmers realise that the Queensland Producers' Association has the capacity to do things, has the capacity to make representations, and has not only the ear of the Government but also the imprimatur of the Government, I think that talk about the formation of a conflicting organisation that cannot achieve any more than this organisation can achieve, but, on the contrary, will handicap, to a degree, the operations of the organisation by dissipating its energy and total forces, will cease."

Going on to discuss the problems of agriculture generally, Mr. Bulcock added that definite progress had been made during the year in examining and determining the values of available water supplies for water conservation and irrigation. That work had progressed very satisfactorily, and side by side with it a Government committee had been working with representatives of his department, examining every aspect of water conservation and fodder conservation, particularly fodder conservation. This committee had done some remarkably good work.

As Minister for Agriculture, he regarded efficiency as one of the big things underlying all forms of agricultural work. "The people generally," he continued, "never express any resentment at farmer-control or producer-control, but they do say that there is an obligation on the part of the producer and allied interests, to give the Australian market the very best that they are capable of producing. I personally appeal to you to do all that you can to assist the home consumption price by giving the people the utmost efficiency in the production of the products that you desire to sell."

Organised Marketing.

ADDRESSING the delegates to the conference subsequently, Mr. Bulcock recalled his long association with the organisation, remarking that he was chairman of the Parliamentary Agricultural Committee at the time the original Act was before the Queensland Parliament, and that he had continued a sustained association with the entire industry ever since. To-day every country in the world was organising primary producers and tackling their problems along economic as well as cultural lines.

In spite of the opposition they sometimes encountered from inspired sources, neither the public nor the producer would be willing to sacrifice the advantage of organised marketing. The public generally did not realise that marketing boards in Queensland handled millions of pounds per annum, yet the cost of living was lower in Queensland than in any other State of the Commonwealth.

Antagonists so often declared that organised marketing increased the cost of living to the consumer; but rather did it seek to protect the public, and it had succeeded materially in affording the public that protection.

Mr. Bulcock referred to the resolution adopted by the Australian Agricultural Council, composed of Ministers for Agriculture of all the States, which met in Brisbane the same day, affirming its faith in and the necessity for a continuance of organised marketing. This, he said, was one of the most important achievements in regard to organised marketing since the judgment of the Privy Council.

Was it not surprising, the Minister went on, that farming was the only form of human endeavour that so often was denied the right to some form of organisation. The moral right must be greater than the legal right.

Mr. Bulcock added that he was convinced the time was past when there should be rapid changes in the personnel of pool boards. Instead of having a one-year tenure, pool boards should have not less than three years of office, and he hoped before long to have constituted every pool board for a three years' term. This was because he believed that continuity of policy was essential, and because no one could plan a policy and do justice to it and his organisation in one year.

The Romance of Sugar.

IN this issue is published a very interesting account of the development and progress of the Australian sugar industry. The annual report of the Bureau of Sugar Experiment Stations, which was tabled in the Legislative Assembly recently, is equally interesting as a record of contemporary progress in an industry which means so much to the Commonwealth.

No Australian industry is more important than cane sugar production, and, outside Queensland, few are so little known. Its special function in our national economy is not appreciated as widely as it should be. To it is due almost entirely the continued success and stability of the settlement of our tropical lands. Nearly forty per cent. of the area of this continent is situated north of Capricorn. In that vast region are some of our richest agricultural, pastoral, and mineral country. Through sugar, Australian population has increased at a greater ratio in the North than in any other portion of the Commonwealth. The wealth and progress of the thriving cities along the Queensland coast are based largely on sugar. Practically every secondary industry in the State depends on it in one way or another.

Every sugar mill is equipped with machinery made in Australian shops and foundries. Apart from fixed assets, in which many millions of good Australian money has been invested, there are recurring annual replacements of plant supplied by protected secondary industries. As a field for regular rural employment the sugar industry is one of the most extensive in Australia. Added to the vast army it employs in field and factory are the workers in the other industries that look to it as a profitable market for their products; the workers in the transport services; and the workers in the refineries, which are situated in every State capital.

Our sugar business therefore is something more than a simple sum in arithmetic; and the continuance of the industry on a satisfactory basis, and the consequent further development of our tropical lands, are among the bare essentials for the security of Australian hearths and homes.

Codling Moth Control Experiments, 1936-37.

HUBERT JARVIS, Research Officer.

THE need for a satisfactory substitute for lead arsenate in the control of codling moth has been apparent for a considerable time. Various alternative sprays and spray combinations have been used more or less successfully, but lead arsenate, which is both cheap and usually reasonably efficient, is still the most widely used insecticide for this purpose.

In the Stanthorpe district, experiments with non-arsenicals for the control of the codling moth were initiated in 1932 (Jarvis, 1933), and a nicotine sulphate-white oil spray then proved slightly more efficient than lead arsenate, though much more expensive. Subsequent work in the 1933-34 season (Jarvis, 1935) confirmed these experimental results, and also indicated that potash soft soap might have some value as a codling moth insecticide. In the 1935-36 season, the pest was very prevalent, and even where a lead arsenate spray schedule was conscientiously adhered to by the grower, fruit losses were considerable. Hence when the moths are very numerous, lead arsenate is by no means adequate and suffers the further disability that the numerous sprayings necessary, under such conditions, frequently leave undesirable residues which persist on the fruit until harvesting.

In the same season, i.e., 1935-36, it was noted that the addition of a contact insecticide to the lead arsenate spray gave beneficial results. This, in conjunction with the known properties of the nicotine sulphate-white oil combination suggested that further work on spray materials of a non-arsenical nature was justified. Additional evidence in support of this viewpoint was obtained on a plot used for fruit fly control experiments in 1935-36, as some of the sprays, e.g., colloidal sulphur-potash soft soap, incidentally gave quite good control of codling moth. The more promising of these sprays were used in comparative trials during the season 1936-37.

Experimental Material and Methods in 1936-37.

The experimental plot was situated in the Summit area, and comprised thirty apple trees of the Rome Beauty variety, distributed in a single row. The Rome Beauty is a late maturing variety subject to codling moth attacks over a relatively long period. Owing to the irregular incidence of frost damage in the orchard, the crop varied considerably from tree to tree, but the yield averaged two cases per tree.

The season was comparatively dry throughout, though heavy rains fell on and about 12th January.

The thirty trees were equally distributed among nine treatments and a check, allowing for three replications and general randomisation. The treatments were as follows:—

A. Bentonite sulphur-nicotine sulphate—2½ lb. bentonite sulphur: 1 pint nicotine sulphate: 80 gallons water: 2 oz. spreader.

B. Colloidal sulphur-nicotine sulphate—2½ lb. colloidal sulphur: 1 pint nicotine sulphate: 80 gallons water: 2 oz. spreader.

C. Commercial lime sulphur—1 gallon lime sulphur : 50 gallons water : 2 oz. spreader.

D. Commercial lime sulphur-nicotine sulphate—1⅗ gallons lime sulphur : 1 pint nicotine sulphate : 80 gallons water : 2 oz. spreader.

E. Thiodiphenylamine—2½ lb. thiodiphenylamine : 80 gallons water : 2 oz. spreader.

F. Nicotine sulphate-white oil—1 pint nicotine sulphate : 1 gallon white oil : 80 gallons water.

G. Potash soft soap*—10 lb. potash soft soap : 80 gallons water.

H. Lead arsenate—2½ lb. lead arsenate : 80 gallons water : 2 oz. spreader.

I. Colloidal sulphur-potash soft soap—2½ lb. colloidal sulphur : 10 lb. potash soft soap : 80 gallons water.

J. Control.

A spreader was used in all sprays other than those containing white oil or potash soft soap.

A lead arsenate calyx spray was applied to all trees other than the controls, the five cover sprays following as indicated in Table I.

TABLE I.

Spray.	Date.	Interval.
		Days.
Calyx spray	21-10-36	
First cover spray	4-11-36	14
Second cover spray	19-11-36	15
Third cover spray	10-12-36	22
Fourth cover spray	4-1-37	25
Fifth cover spray	8-2-37	35
Fruit harvested	5-3-37	25

The experimental trees were kept under more or less continuous observation, windfall fruit being collected each week and examined for codling moth damage. Thus, at the completion of harvesting, every fruit borne by the trees had been inspected and records kept which indicated both the source of loss and, in the case of codling moth injury, the point of larval entry.

At the blossoming period the weather was unusually cold with low night temperatures. The spring brood of codling moths emerging from hibernating larvæ was consequently both late in appearance and comparatively low in numbers. Calyx infestation was small correspondingly, and the following figures indicate that, in fruit which is approaching maturity, grub entrances are mainly at the side and not at the calyx end of the fruit.

Injured Fruits.	Position of Larval Entry. Calyx Entry.	Side Entry.
1,070	216 (20·1 per cent.)	854 (79·9 per cent.)

Spray Injury.

(a) Attributable to Spreader.

The fruit on all the trees treated with sprays in which a spreader was used showed surface spotting which was particularly severe in the case of

* The potash soft soap used in these experiments possessed the following analysis:—

	Per cent.
Fatty anhydrides	46.1
Alkali as Potash (K_2O)	10.4
Alkali as Soda (Na_2O)	.33
Alkali as free caustic	.05
Alkali as free carbonate	2.46
Glycerine	5.2
Water	38.3

thiodiphenylamine and lead arsenate. Comparable spotting was absent on trees treated with sprays devoid of the spreader and also on the controls. It would seem probable that the spreader was to some extent responsible for the damage.

The spots varied in size from 1 millimetre in diameter downwards and were quite superficial. As many as 100 occurred on some fruits, but the blemishes were not serious enough to prejudice the sale of the apples on the Australian market, though badly spotted fruit would not be suitable for export purposes.

The injury may be due to the exceptional qualities of the spreader having facilitated insecticidal penetration through the lenticels. Possibly greater dilutions of the spreader may eliminate the susceptibility of the fruit to spotting without impairing the spreading efficency of the several sprays to any great extent.

(*b*) *Attributable to lead arsenate.*

The trees in the experimental plot, which were treated with lead arsenate in both calyx and cover sprays, all showed signs of leaf scorch, and stood out distinctly from the rest of the plot on this account. Somewhat similar, though much less acute, injury was also noticed in trees sprayed with thiodiphenylamine. In the remainder of the orchard where the lead arsenate schedule was used, scorch was also present on all varieties of apples other than a few trees which, owing to the absence of fruit, were omitted from the spray treatment. Jonathans apparently suffered more severely than other varieties of apple.

During recent years leaf scorch has been increasing in severity in the Stanthorpe district. The trouble has been assigned to various causes, e.g., unfavourable growing conditions and nutrient deficiencies. At the same time the losses caused by codling moth have induced growers to increase not only the frequency but also the strength of the lead arsenate sprays used for the control of the pest. Observations during the current year indicate that in the Stanthorpe district, at least, the amount of lead arsenate required to effect reasonable control of codling moth may be harmful to the trees by producing some form of leaf scorch.

Discussion of Experimental Results.

In interpreting the tabulated results only major differences can be tentatively regarded as significant. Nevertheless, a number of the non-arsenicals gave control as good, if not better, than lead arsenate. Three of these non-arsenicals—bentonite sulphur-nicotine sulphate, colloidal sulphur-nicotine sulphate, and nicotine sulphate-white oil—all possess nicotine sulphate in common. Lime sulphur-nicotine sulphate would be expected to give results comparable with colloidal sulphur-nicotine sulphate, but a single tree, No. 19, in the former series suffered severe damage, and the weighted mean percentage of sound fruit for this treatment is consequently low. The habit of growth in this tree was such that effective spraying was almost impracticable, and it is probable that a repetition of the work would give better results with lime sulphur-nicotine sulphate.

The value of nicotine sulphate in the control of codling moth is further indicated by an examination of the results of the plots treated with lime-sulphur and lime-sulphur-nicotine sulphate. The other constituents in joint sprays containing nicotine sulphate may either supple-

ment the latter by their own insecticidal properties or increase the period over which the nicotine sulphate is effective. Tests with the single and joint sprays in the one experimental scheme are necessary to determine this point.

TABLE II.

EXPERIMENTAL RESULTS.

Treatment.	Total Number of Fruits.	Number Attacked by Codling Moth.	Percentage Unattacked per Tree.	Percentage Unattacked per Treatment.	Approximate Cost per 40 Gallons.
					s. d.
A. Bentonite sulphur — nicotine sulphate .. .. .. Tree Nos. 1, 13, 21 ..	98 80 141	0 8 12	100 90 91·5	93·8	*
B. Colloidal sulphur — nicotine sulphate .. .. .. Tree Nos. 2, 12, 25 ..	59 90 295	1 6 18	98·3 93·3 93·9	94·4	6 0
C. Lime sulphur .. .. .. Tree Nos. 3, 15, 23 ..	126 200 184	61 37 67	51·6 81·5 63·6	67·7	1 10½
D. Lime sulphur — nicotine sulphate .. .. .. Tree Nos. 4, 19, 27 ..	58 258 128	7 105 7	87·9 59·3 94·5	73·2	5 2
E. Thiodiphenylamine .. .. Tree Nos. 5, 18, 29 ..	219 284 186	38 92 30	82·6 67·6 83·9	76·7	*
F. Nicotine sulphate—white oil Tree Nos. 6, 20, 26 ..	74 350 407	2 3 9	97·3 99·1 97·8	98·4	6 1
G. Potash soft soap .. .. Tree Nos. 7, 11, 30 ..	97 241 98	5 2 2	94·8 99·2 98·0	98·0	2 0½
H. Lead arsenate .. .. Tree Nos. 8, 14, 24 ..	167 122 369	33 31 40	80·2 74·6 89·2	84·2	1 6
I. Colloidal sulphur—potash soft soap .. .. .. Tree Nos. 9, 16, 28 ..	125 151 118	2 7 3	98·4 95·4 97·5	97·0	4 4
J. Controls. .. .. .. Tree Nos. 10, 17, 22 ..	269 344 208	135 154 153	49·8 55·2 26·4	46·2	——

*Not available.

Spray costs based on the following prices:—

	s.	d.	
Lead arsenate	1	0	per lb.
Lime sulphur	9	0	per 5-gallon tin.
Colloidal sulphur	5	6	per 3 lb.
Potash-soft soap	2	10	per 7 lb.
Nicotine sulphate	27	6	per ½ gallon.
Spreader	3	10	per lb.

A second group of sprays, potash soft soap and colloidal sulphur-potash soft soap, gave excellent results in controlling the pest. The value of potash soft soap is somewhat difficult to explain. Like most soaps, the spray should possess larvicidal and, perhaps, ovicidal properties, while the small amount of free caustic potash may be of value.

The two recognised stomach poisons, lead arsenate and thiodiphenylamine provided reasonable control, the latter being somewhat inferior.

In any spray schedule for the control of codling moth, three considerations are important, viz.:—

1. Residues on the fruit of any kind, toxic or otherwise, are undesirable. Lead arsenate used according to the commoner spray schedules suffers from this disability, and its continued use is largely attributable to its relatively low cost and reasonable efficiency. Washing with various solutions, chiefly a dilute hydrochloric acid bath, is frequently necessary. Of the several sprays used in this experiment only one, bentonite sulphur-nicotine sulphate, left excessive deposits. Even after careful washing the bleached appearance of the surface from which residues had been removed contrasted unpleasantly with the natural colour of the fruit. It is improbable, therefore, that bentonite sulphur-nicotine sulphate, as at present available, can be used to advantage for codling moth control.

2. Joint sprays are sometimes preferable to single purpose sprays. Codling moth is only one source of loss, for both powdery mildew and red mite are apt to be troublesome. Sulphur in some form or other is useful for the control of these, and in an already heavy spray schedule the incorporation of sulphur with an effective insecticide for the control of codling moth is frequently desirable. All the sprays used containing sulphur gave control of both powdery mildew and red mite, while nicotine sulphate-white oil and potash soft soap both adequately controlled red mite.

3. Costs must not be excessive. The cost of insecticides in the spray programme necessitated by codling moth infestation is already considerable, even with a lead arsenate schedule. In Table II. the cost per 40 gallons of the several sprays used for which prices are available is indicated. From a purely codling moth control viewpoint, taking into account both efficiency and cost, potash soft soap is the only spray material which compares at all favourably with lead arsenate. Rather than use a combined spray for this purpose at a much higher cost, it would obviously be preferable to treat the potash soft soap as a single purpose spray, adding sulphur or some such ingredient when the exigencies of the disease situation require it. Costs would thus be kept within reasonable dimensions.

Summary.

1. The experiment was designed to compare various non-arsenical sprays with the lead arsenate schedule for the control of codling moth, all trees receiving an initial lead arsenate calyx spray.

2. The majority of the injured fruits were penetrated by the larvæ at the side and not at the calyx end of the fruit.

3. Superficial injury to the rind of the fruit is attributed to the spreader, and the possible association of leaf scorch with the use of lead arsenate for the control of codling moth is discussed.

4. Five non-arsenical sprays, bentonite sulphur-nictotine sulphate, colloidal sulphur-nicotine sulphate, nicotine sulphate-white oil, potash soft soap and colloidal sulphur-potash soft soap, gave very promising results. Potash soft soap alone compares favourably with lead arsenate so far as price is concerned, and, as colloidal sulphur can conveniently be added when necessary for the control of powdery mildew and red mite, more exhaustive studies of this insecticide will be carried out in the coming season.

Acknowledgments.

Thanks are tendered to Mr. R. Wells for making available experimental trees on his orchard, and to Mr. Robert Veitch, Director of Plant Industry (Research), for his critical interest in the work.

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HOME-MADE GATE HINGES.

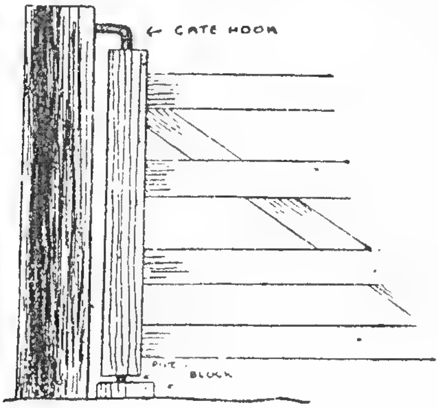


Plate 94.

Two methods of making cheap and effective gate hinges are illustrated. In the first the ordinary gate hook—or a round iron bent to a right angle—is driven into the hingle post with the point downwards. A block on which the gate is to turn is sunk in the ground immediately under this, and is bored to take a short length of ½ inch or ¾ inch piping. The timber joining the hinge end of the gate is also bored

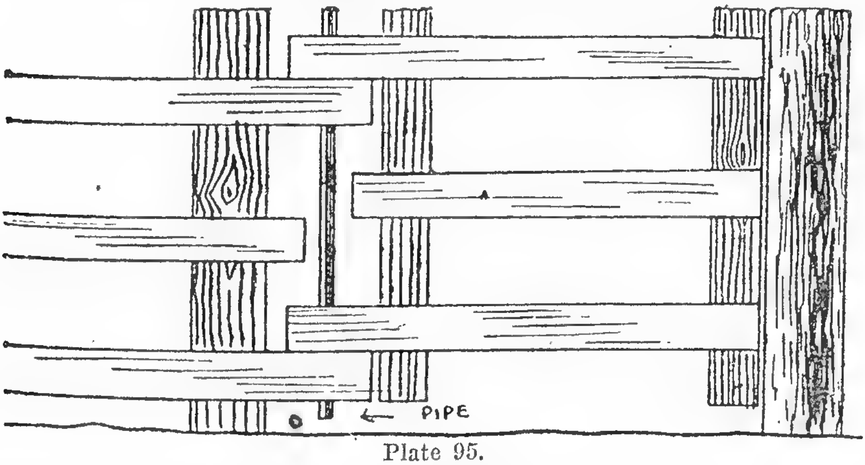


Plate 95.

to receive these irons, ground block is raised to the correct height and rammed after the gate is fitted to the hinges. In the second illustration two rails on both fence and gate are extended and bored to take a length of ¾ inch pipe, which acts as an efficient hinge.

Sown Pastures and their Management.

C. W. WINDERS, B.Sc.Agr., Assistant Agrostologist.

[*Continued from p. 135, Part 2, Vol. XLVIII.—August,* 1937.]

(PART III.)

NUTRITIVE VALUE OF PASTURES.

A SINGLE chemical analysis of a plant is insufficient of itself as a basis on which to estimate the plant's feeding value. The nutritive value of a pasture grass or clover depends upon its palatability, chemical composition, and digestibility, and upon the class of animal to which it is fed. Three generalisations may be made, namely:—

1. The stage of growth and conditions of growth have a marked influence on the nutritive value of pasture.
2. Chemical analyses give some idea of the feeding value, but only through the grazing animal can palatability and digestibility be determined.
3. All things considered, certain pasture plants have a higher nutritive value than others.

A good deal of evidence has been adduced tending to show that the young growth of most pasture plants is superior in feeding value to the mature growth. Short, young pasture, growing under good conditions, is well provided with proteins, fats, carbohydrates, and minerals—all in a highly digestible form. As the pasture grows older the protein and mineral contents generally fall and indigestible fibre increases at the expense of the carbohydrates. In view of this general trend, different plants cannot be compared on their chemical analyses unless the samples represent material of approximately the same stage of growth. Whilst most pasture plants are of higher feeding value when young than when mature, certain plants only become palatable after maturity, and so the young growth is actually of little or no value to stock. The palatability and chemical composition of pasture plants vary with seasonal conditions and with soil fertility as well as with the stage of growth.

The value of chemical analyses in comparing feeding values is lessened by the fact that palatability and digestibility are factors as important as the quantity of the different nutrients in each 100 lb. of the pasture. Obviously, if a plant is neglected entirely by stock as a consequence of its unpalatability its feeding value is nil. Again, a particular plant might appear on the basis of its chemical analysis to have a high feeding value, yet actually might be an inferior fodder because of the indigestible nature of its contents. Unfortunately, feeding trials to determine the exact value under all conditions of each of the better-known pasture plants would involve a tremendous amount of work and expense; but information in regard to certain species is being collected. Where digestibility figures are not available, palatability tests and chemical analyses (the latter interpreted in a commonsense manner) must form the bases of comparative tables.

It is apparent to all who have had experience with various pasture types that some plants (for example, paspalum, Rhodes grass, Kikuyu grass, and lucerne) are of much greater value for feeding purposes generally than are spear grasses, barbed-wire grass, and the like. Feeding trials probably would reveal the fact that plants of the former group

contain a higher proportion of digestible nutrients than those of the latter series, and chemical analyses certainly point that way. Clovers and other legumes of recognised pasture value generally differ from grasses in possessing a higher proportion of proteins in relation to fats and carbohydrates, and a higher proportion of useful minerals.

A very large number of chemical analyses of pasture plants have been made by the Agricultural Chemist of the Department of Agriculture and Stock, and selected analyses are set out in the accompanying table (Table I.). In addition to indicating in some measure the distinctions between various pasture plants, the analyses in many instances show the differences between young growth and mature growth. All the analyses recorded in the table have been made after the water has been removed from the plants by oven-drying.

TABLE I.

Plant.*	Description of Sample.	Analysis of water-free material.				
		Crude Protein.	Crude Fat.	Crude Fibre.	Analysis of ash.	
					Lime.	Phosphoric Acid.
		%	%	%	%	%
Para grass	Young, leafy growth	24·8	0·6	23·2	0·666	0·675
	Mature growth	5·8	1·0	38·0	0·368	0·208
Buffel grass	Young, leafy growth	18·0	1·6	27·0	0·953	0·670
	Stemmy plants	6·1	1·3	37·0	..	..
Rhodes grass ..	Young, leafy growth	16·4	1·7	27·1	1·199	0·724
	Old, stemmy growth	5·8	1·2	33·3	0·579	0·604
Couch grass	Leafy growth	18·2	1·3	23·5	0·868	0·607
African Star grass ..	Young, leafy growth .. .. (one sample only)	30·1	2·5	18·8	1·184	0·831
Blue couch grass ..	Leafy growth	18·3	2·0	24·4	0·522	0·776
Woolly finger grass	Leafy growth	20·0	2·1	27·2	0·358	0·628
	Coarse, in full seed	6·5	0·8	37·9	0·236	0·216
Molasses grass ..	Young growth	11·9	1·4	28·4	0·244	0·239
	Coarse growth after seeding ..	3·3	0·8	40·8	0·416	0·172
Giant panic grass ..	Leafy growth	19·2	1·9	19·5	0·542	0·365
	Stemmy material	6·2	0·7	30·4	0·347	0·476
Guinea grass ..	Young, leafy growth	13·1	0·9	25·8	1·278	0·757
	Old, stemmy growth	4·5	0·6	39·7	0·410	0·148
Paspalum	Short, young grass	20·6	1·6	23·7	0·412	0·618
	Old, stemmy growth	4·1	0·9	41·4	0·239	0·139
Kikuyu grass ..	Young growth	16·7	1·4	31·2	0·436	0·884
	Growth from old plants ..	8·8	1·4	27·1	0·416	0·697
Elephant grass ..	Young shoots	21·0	1·5	23·2	0·764	0·429
	Shoots from 7 feet stalks ..	7·0	0·7	44·1	0·197	0·081
Cowcane	Young, new growth	12·8	1·1	31·0	1·089	0·731
	First ratoon cane	2·2	0·6	27·6	0·284	0·181
Prairie grass ..	Short, young grass	29·2	3·6	19·3	1·142	0·827
	Older growth	5·0	1·7	31·9	..	..
Cocksfoot	Short, young grass	24·9	3·4	17·5	0·643	0·365
	Older growth	10·6	3·3	31·0	0·828	0·946
Perennial rye-grass ..	Short, young grass	21·6	2·9	19·3	1·025	0·954
	Older growth	12·7	1·1	22·3	0·718	0·938
Wimmera rye-grass ..	Short, young grass	24·7	2·3	19·7	1·014	1·189
	Older growth	6·8	1·7	22·5	..	..
Italian rye-grass ..	Short, young grass	22·7	1·9	19·9	1·000	0·986
	Older growth	10·6	1·8	20·9	..	..
Phalaris	Short, young grass	25·9	2·9	19·6	0·503	0·338
	Older growth	10·8	3·8	27·7	0·818	1·132
Lucerne	Young, leafy growth	29·4	1·2	17·0	1·979	1·010
	Old, mature growth	18·4	1·2	32·6	3·545	0·679
Townsville lucerne ..	Young, succulent growth ..	14·2	1·0	25·9	2·500	0·503
	Older growth	13·5	1·5	32·1	1·534	0·243
Burr medic	Immature growth	29·5	0·9	16·4	1·390	0·991
	Mature growth	28·8	0·9	18·4	1·461	0·948
Black medic	Hay stage	15·5	1·8	18·7	2·391	0·858
Red clover	In flower	23·0	1·7	15·4	3·245	0·756
	Full hay stage	19·0	1·6	17·8	3·540	0·790
White clover ..	Young, leafy growth	29·9	1·5	16·9	1·569	1·185
	Old growth	18·1	1·5	22·1	2·078	0·528
Wheat	Young, leafy growth	33·0	3·4	19·7	0·836	1·611
	Older growth	10·2	2·7	27·9	0·484	0·721
Oats	Young, leafy growth	33·3	3·1	20·8	..	..
	Older growth	13·3	3·6	26·1	0·715	0·975

* A check list of common and scientific names of the chief pasture plants is contained in a later section.

PERMANENT SUMMER-GROWING GRASSES.

Para Grass (*Brachiaria mutica* Stapf).

Origin and Distribution.—Para grass, also known in Queensland as *Panicum muticum*, panicum, giant couch, or Bancroft grass, is a native of either Brazil or tropical Africa, used extensively in many tropical and sub-tropical countries for grazing and fodder purposes. It was introduced to Queensland about 1880, and is now grown in scattered areas right along the eastern seaboard, which has a moderately heavy to extremely heavy rainfall, and to a slight extent in frost-free areas up to 100 miles from the coast. Para grass can be recommended for use on coastal dairy farms and grazing properties as an adjunct to other cultivated pastures, or as the main cultivated pasture in certain areas, and if planted in damp situations will represent a marked improvement on the usual feed available in such places.

Plate 96.

Para grass, showing habit of growth.

Description.—Para grass (Plate 96) is a rapidly-growing perennial grass with broad, hairy leaves up to 12 inches in length. Its early habit is to produce stout runners which grow along the surface of the ground and form a shallow root system at each joint. Later, upright shoots are developed at the joints and the creeping stems themselves turn upwards. The latter spread very quickly, and the area occupied by the grass rapidly increases in extent and in density of cover. The grass may reach a height of several feet under favourable growing conditions, and usually the stand is so dense that only plants of a similar straggling habit are able to grow in competition with it. Though the grass flowers in Southern Queensland, it is only in the tropics that seedheads are produced in any appreciable quantity. The seedhead has the form of a number of 1-3-inch spikes occurring at irregular intervals along the top 6-9 inches of the seed stalk.

Climatic Requirements.—The distribution of Para grass is a reflection of its climatic requirements. Essentially a grass of the tropics and sub-tropics, it is cut back severely by frosts, and so is less desirable

than certain other grasses for areas subject to low temperatures. In heavy rainfall districts it thrives during the wet season, and is sufficiently drought-resistant to survive (and, in many instances, produce a moderate amount of feed) during the long, dry period experienced on parts of the coast during the autumn, winter, and spring months.

Soils.—Para grass evinces a preference for soils which retain moisture well, and will thrive on waterlogged soils and even in water-holes and streams. On porous soils and on dry and infertile soils it is of little value.

Planting.—Unless it is harvested very carefully, seed of Para grass is likely to be of extremely poor quality and unsuitable for sowing purposes. Sowings of well-filled seed made at the rate of 2 to 3 lb. per acre have in some instances produced good stands. The usual method of propagation is to plant stem cuttings. Each cutting should have two or three joints; and, when planted, at least one joint should be buried in the soil. Rooting takes place at the buried joints, and if the cuttings are planted up to 5 feet apart each way, a good ground cover of runners is quickly obtained on clean land. An alternative method, which might well be used where ample fresh stems are available, is to run out furrows 3 feet apart and scatter mowings or chopped-up pieces of the stems in them covering them with a plough. On fresh scrub burns stem pieces probably would strike if scattered on the ashes during wet weather, but "dibbling-in" is preferable. The grass requires from two to six months to become established sufficiently well to permit of grazing or cutting.

If land intended for Para grass pasture is cultivable it should be ploughed and cultivated in order to provide good soil conditions for the grass. On areas carrying logs or stumps, or which are too wet for ploughing, the grass must be mattocked in. The best time to plant is during the spring or summer months, the actual time depending on the moisture content of the soil and the prospects of seasonal rains.

Though in Queensland Para grass is usually planted in a pure stand, it is reported from various other countries that both the productivity and the feeding value of the pasture may be increased by annual sowings of cowpeas or velvet beans. These legumes are sown when the pasture grass is being planted, and in subsequent years planted in holes made in the sod with a sharp stick, or, better still, broadcasted after a shallow ploughing of the sod.

Management.—Para grass commonly is both grazed and cut for green feed. On farms where only small patches of the grass exist the usual practice is to cut the grass with a hook or scythe, and feed the green material to stock. More extensive areas are used for grazing, but precautions should be taken to prevent damage to the pasture. The runners of the grass must be permitted to secure a firm foothold before the young stand is grazed, and continuous heavy grazing of the pasture must be avoided. Grazings or cuttings should be regulated in such a way that the feed is used before it becomes coarse.

Conservation.—Para grass should be quite suitable for silage purposes, but its use as hay is likely to be small in the wet districts in which it grows best.

Feeding Value.—The palatability of the young growth of Para grass to all classes of stock is high, and its feeding value quite good. The older growth is dry and woody and has a reduced feeding value.

Pests and Diseases.—Comparative freedom from pests and diseases is a feature of Para grass, which renders it of particular value in paspalum areas as an alternative pasture to ergot-susceptible paspalum. A Coccid bug, with which is associated a sooty mould, attacks the young shoots, but does not cause serious damage.

Special Uses.—Para grass may be used for reclaiming boggy areas of land. It also is useful as a soil-binder.

Undesirable Features.—Within recent years Para grass has come to be looked upon with disfavour in certain areas (particularly on the Upper Tweed River in New South Wales), because of its habit of invading irrigation channels and small streams and impeding the flow of water.

The grass may also assume pest proportions on low-lying cultivation lands if steps are not taken to destroy the plants before they have gained a hold on too large an area. Where heavy infestations occur the land can be cleared by hard grazing during a dry spell.

Rhodes Grass (*Chloris Gayana* Kunth.).

Origin and Distribution.—Rivalled in importance only by *Paspalum dilatatum,* Rhodes grass is now grown over a wide area in Queensland and is the chief pasture grass in many districts too dry to support paspalum pastures. It is a native of Southern Africa and has been introduced for pasture purposes to many sub-tropical and warm temper-

Plate 97.

A stand of Rhodes grass in the hay stage.

ate countries. It is understood to have reached Queensland from New South Wales about 1905. It quickly came into favour throughout the Burnett district and on the Atherton Tableland, and was grown as far west as Mitchell, in the Maranoa, by 1912. During the first decade following its introduction to Queensland, Rhodes grass was sown almost entirely on land cleared of softwood scrub or brigalow scrub; but, within the past twenty years, a good deal of fertile forest country has been laid down to it. Since the introduction of the prickly-pear parasite, *Cactoblastis cactorum,* many thousands of acres of reclaimed brigalow scrub country have been brought into economic production by the sowing of Rhodes grass.

Plate 98.
Rhodes grass.

A good deal of Queensland, within the climatic zone satisfactory for Rhodes grass, possesses soils suited to the grass. This includes not only the land at present devoted to dairying but also vast areas of grazing country now carrying native grasses or timber. The extension of the Rhodes grass areas on to grazing properties has now commenced, and a rapid expansion is likely when graziers generally come to realise the increase in carrying capacity which may be obtained by replacing certain native grasses and trees by such a heavy-yielding pasture and hay grass as Rhodes grass.

Description.—Rhodes grass (Plate 98) is a perennial, tufted plant, with erect, leafy flowering stems and spreading surface runners which root at the nodes or joints. So readily are the runners formed that a good ground cover is obtained within a few months of sowing under favourable soil and weather conditions. From each node of the runners are produced leafy stems which may attain a height of over 4 feet. The long flowering stems bear at the top clumps of 10-14 radiating, brownish-green seed spikes.

Climatic Requirements.—Rhodes grass is primarily a summer grower, making most of its growth during the period October to April. The areas best suited to the grass are those receiving an average annual rainfall of between 25 inches and 50 inches, of which most falls during the warmer months of the year. Districts receiving as low an average rainfall as 22 inches per annum may be suitable for Rhodes grass if the distribution of the rainfall is not extremely erratic. Protracted droughts often cause severe damage to Rhodes grass pasture, since the grass is not particularly adapted for drawing on deep-seated water supplies and has poor recuperative powers. Nevertheless, Rhodes grass may be considered fairly drought-resistant. Its resistance to frost injury is not of a high order.

Soils.—Rhodes grass is grown on a variety of soil types, but thrives best on loams, ranging from sandy loams of good-class forest country through red volcanic loams originally carrying softwood scrubs to clay loams of brigalow scrub areas. Light sandy soils and heavy black soils are not so suitable. On the latter type it is difficult to establish the grass satisfactorily.

Planting.—Being a summer-growing plant, Rhodes grass is best sown in the spring or early summer. If sown in the late summer, there is a danger of the young plants being destroyed by early frosts, and, similarly, late frosts may play havoc with very early plantings. Broadcasting by hand is the usual method of distributing the seed. Rhodes grass seed is variable in quality and seldom reaches a high standard of germinability. Occasional samples reach 80 per cent. germination, but many commercial lines fail to reach the standard of 30 per cent. prescribed by the Queensland Pure Seeds Acts. If good-quality seed is sown, 4 to 5 lb. per acre is sufficient to sow, but where there is any doubt as to the germinability heavier sowings, up to twice that quantity per acre, should be made.

Owing to the lack of a suitable pasture legume for sowing in conjunction with it, Rhodes grass is usually sown alone. In many districts light sowings of lucerne could be made in admixture with Rhodes grass, but in cotton-growing areas lucerne is a breeding crop for the destructive corn-ear worm of cotton. Various other legumes are being tested to determine their usefulness in Rhodes grass pastures.

Management.—The general principles of pasture management, as set out in an earlier section, should be applied in the management of Rhodes grass pastures. The pasture areas should be suitably subdivided to allow of short, intermittent grazings of each paddock, and the grazing should be so controlled that each paddock is eaten off when the growth is young and leafy. Hard grazing, particularly on light soils, must be avoided. The scattering of manure lying on the pasture should be regularly carried out wherever a suitable inplement can be worked.

The mechanical treatment of Rhodes grass pastures is carried out by some farmers and appears to be productive of good results. Renovation may be carried a stage further by the judicious use of artificial fertilizers, such as superphosphate and sulphate of ammonia. Under heavy stocking conditions any renovation of Rhodes grass pastures by harrowing and top-dressing can be only temporary in nature, and the measures taken must be repeated at frequent intervals if the pasture is to be maintained in a high state of production. The position would be different if the pasture contained a reasonable proportion of legumes, for then top-dressing with superphosphate would be expected to stimulate the growth of the legumes and so indirectly enrich the soil in nitrates, &c.

In the absence of a leguminous element from the Rhodes grass pasture, the rejuvenation of old stands is a less effective means of pasture regeneration than is the sowing-down of fresh pastures following soil improvement. Probably old Rhodes grass land which has been ploughed up and cropped with lucerne for two or three years would sustain a good Rhodes grass pasture for some years following the ploughing-out of the lucerne. Other cropping programmes, with Rhodes grass occupying the land in most years, could be devised.

Conservation.—The fact that Rhodes grass is a valuable hay grass is not recognised sufficiently in Queensland (Plate 97). Provided that the stand is of a good type (that is, containing a preponderance of plants with abundant leaf and slender stems), a useful hay can be made from the grass. The quality of the hay, particularly its palatability, is rather variable, but all classes of stock will eat it without much waste. The yield also is variable, of course, but on fertile soil young stands should provide at least two cuttings, each of 1½ to 2 tons of hay, per annum. In the fairly dry areas in which Rhodes grass is grown largely the hay is easily cured. In most instances it should be in the stack within forty-eight hours of cutting. The last cutting for hay should be made some weeks before the weather becomes really cold, in order to permit of the growth of aftermath suitable for winter grazing. Where frosts are experienced a growth of about 2 feet should be provided for; the upper part of this will be frosted, but the sheltered basal shoots will provide some picking.

In addition to its usefulness as hay, Rhodes grass should be valuable as silage. A yield of from 4 to 6 tons of green material per acre may be expected.

Feeding Value.—As a rule, provided it is cut or grazed before it matures, Rhodes grass is of moderate to high palatability, though in the coastal districts, and on certain types in the drier areas, the plant is often neglected by stock. Its recovery after grazing or cutting is good, particularly so in young stands, provided that the weather conditions

are not adverse. The feeding value of the leafy material of Rhodes grass pastures growing under favourable conditions is excellent, the grass being rich in proteins and other nutrients.

Seed Production.—The bulk of the Rhodes grass seed sold in Queensland is produced within the State and is harvested by hand.

Pests and Diseases.—Rhodes grass pastures fortunately are little affected by pests and diseases. Outbreaks of white grubs of the genus *Rhopœa* have occurred in the southern part of the State on basaltic scrub soils and there is some danger of the pest assuming serious proportions. Red spider occasionally causes slight damage, whilst Coccid injury is of some consequence. Rust is a rare ocurrence.

Special Uses.—On account of its running habit, Rhodes grass is of some value in protecting soil from erosive agencies.

Undesirable Features.—Some farmers hesitate to plant Rhodes grass on land which they intend to use in the future for cultivated crops owing to a fear that its subsequent eradication will prove difficult. This fear, however, is groundless, as Rhodes grass has no underground runners and is destroyed easily by ploughing and ordinary cultivation.

Paspalum (*Paspalum dilatatum* Poiret).

Origin and Distribution.—A native of South America, *Paspalum dilatatum* is now widespread in many tropical and sub-tropical countries and is grown as a secondary pasture grass in a number of temperate areas. It was introduced into New South Wales towards the end of last century and rapidly came into favour in the coastal areas of that State. The grass soon came to be employed in coastal Queensland and has proved useful, especially under irrigation conditions, in Victoria and Western Australia.

Description.—In habit paspalum (Plate 99) is a perennial tufted grass with clustered, erect stems and shortly-creeping rootstocks by means of which a sown pasture of the grass forms a compact sod. The short underground runners are responsible, in a large measure, for the ability of the grass, once established, to survive heavy grazing, since the growing buds are located underground and so escape damage from trampling. Long, broad leaves are produced in abundance from the crown of the plant and sparingly along the flowering stems. If allowed to mature, a pasture of paspalum may reach a height of several feet; but, except on seed areas, it is unwise to permit the grass to grow taller than 12 inches.

Climatic Requirements.—Paspalum is essentially a summer-growing grass and for its full development requires a warm, moist growing season. Conditions on our tropical coast appear, however, to be somewhat unsuited to paspalum, with the result that the main paspalum areas of Queensland are the South, Lower North, and Central North coastlands, the highlands adjacent thereto (Springbrook, Tamborine Mountain, Maleny Plateau, Blackall Range), the Atherton Tableland, and one or two plateau areas west of the coastal ranges. These areas experience an average annual rainfall of over 50 inches, most of which falls during the summer. Paspalum is grown to some extent in lower rainfall areas, chiefly in low, moist situations; but where the rainfall average is below 40 inches per annum paspalum pastures are of minor importance. As a consequence of its moisture and warmth requirements,

the grass makes almost its entire growth between October and May, with the maximum development during the wet months of January, February and March. Whilst it is unable to persist in dry climates, paspalum is capable of surviving fairly protracted periods without rain. Severe frosts destroy the grass, but light frosts merely retard its growth.

Soils.—A feature of paspalum is its fairly high soil fertility requirement. It will not thrive on poor country and should never be sown on other than fertile soils. Fortunately, most of the "scrub" and better-class forest country on which paspalum was sown up to forty years ago was originally very rich in plant foods and so capable of supporting a productive stand of paspalum for many years. Numerous areas, after having been under grass for a long period, have shown signs of a depletion of soil nutrients, and are in need of special renovation measures.

Plate 99.
A paspalum pasture.

Planting.—Paspalum should be sown in the spring or early summer either on fresh scrub burns or on ploughed and worked-down land of high or reasonably high fertility. A seeding rate of 8 to 12 lb. per acre is recommended. During the summer of 1935-36 an extensive outbreak of ergot occurred in paspalum areas throughout Eastern Australia, and this was repeated to a lesser extent in 1936-37; consequently, there is a possibility that much of the seed coming on to the market for the next year or two at least will be ergotised and of low germinating capacity. Buyers, therefore, should be careful in making seed purchases, and in doubtful cases should submit samples to the Department of Agriculture and Stock for examination. Even in the best commercial lines, however, the percentage of formed seed is rarely greater than 70 and the germinating capacity varies considerably with the age of the seed. It will be found generally that seed twelve months after harvest will have matured sufficiently to reach a standard of 30 per cent.

A delayed germination of sowings of immature seed sometimes is responsible for poor establishment; consequently, only good seed should be used. The usual method of sowing is broadcasting by hand and, if

clovers are to be sown, the area should be gone over twice, first scattering the light grass seed and then distributing the "shotty" clover seeds.

Though paspalum is a very aggressive grass, it will permit certain other pasture plants to mix with it. Notable examples are white clover and tick trefoil, the latter being a prostrate summer-growing legume which has spread naturally into coastal pastures. The ability of white clover to mix with paspalum is of great value, since the clover, after remaining dormant throughout the warm months, produces valuable grazing, in many years, from July to November. Red clover also can be grown quite successfully with paspalum, and various summer and winter grasses will exist for a short time in admixture with it. Lespedeza, a valuable summer pasture legume in the South-eastern United States of America, can be established also in paspalum pastures.

Management.—Of the various types of pasture occurring in Queensland, none is better adapted to intensive management than the good paspalum pasture. Efficient subdivision must be carried out first and the best portion of the farm should receive first attention. The extent of subdivision of the area selected depends upon the size of the herd and on pasture conditions. First-class paspalum areas in the best districts could be subdivided advantageously in such a fashion that when the average number of milkers is concentrated on a paddock the rate of stocking is eight beasts to the acre.

For example, paddocks of five acres each would be about the best size on a farm milking forty cows throughout the warm months. Areas of lower productivity would not be subdivided to the same extent; and on many representative farms 10-acre paddocks would not be too large.

The number of paddocks should be six or more, as this will allow each paddock to be grazed for a few days when the paspalum is five to six inches tall and is of high feeding value. Under favourable seasonal conditions, and using six paddocks, paddock No. 1 should be ready for grazing again after the other five have been grazed in rotation; but where there is great risk of droughts or floods, it would be wise to have nine or ten paddocks for rotational grazing purposes. The animal droppings should be spread in each paddock after the grazing has been completed.

The possibility of the recurrence of epidemics of ergot disease, such as those which occurred in 1935-36 and 1936-37, renders the proper management of paspalum pastures a necessity. The formation of seed-heads must be restricted, either by grazing the grass down before the inflorescences emerge or, where practicable, by the use of a mower. When the number of stock is insufficient to keep the grass from seeding, burning may have to be resorted to, in order to destroy mature growth infested with ergot, but other means should be adopted wherever possible.

Paspalum pastures are particularly liable to decline in production because of adverse soil conditions brought about by various causes. If good pastures are to be maintained, a periodical breaking-up of the matted grass, and of the surface soil, is necessary. Special paspalum renovators have been designed for this purpose. The stump-jump type of tine implement is quite effective if sufficient horse power is available. In cases where tines of different sizes may be fitted, it is advisable to

renovate in one direction to a depth of 5 or 6 inches with the fine points and then to cross-renovate, using the broader points. Before renovation is commenced it is advisable to mow any long, coarse grass on the area. Renovation by these means not only improves soil conditions but removes loose and dead grass and provides a seed-bed for any seeds which may be broadcast.

On badly matted areas ploughing of the paspalum is a more satisfactory way of reinvigorating the pasture. This should be done during the wet period of late summer, when weather conditions are favourable to the re-establishment of the grass. The land should be ploughed with a mouldboard plough deeply enough to turn the sod on to the side. Shallow ploughing, by turning the slice right over and exposing most of the roots to the air, tends to destroy the paspalum. Following the ploughing, the area should be levelled off with harrows, and seeds of white and red clovers broadcast. Such drastic treatment as the ploughing of the pasture will throw the treated area out of production for some months; but, if the farm is subdivided into small areas, one or two paddocks may be ploughed each year, thus providing for the turning-over of each paspalum paddock once every five or six years. The temporary loss of feed occasioned by severe renovation will be more than compensated for by the improved condition of the pasture during subsequent years.

A renovation by mechanical treatment should be followed by the broadcasting of seeds of white clover and red clover. On most soils the addition of between 1 and 2 cwt. of superphosphate per acre will encourage the development of the legumes.

Within recent years there has been a tendency for coastal dairy farmers to increase the cropped area on their farms. A rotation of maize and other crops (including green manures) and pasture probably would be the best method of farming. The pasture should be permitted to stand for only a very few years at a time. The building-up of the organic matter (or humus) of the soil by green manuring crops, such as cowpeas, appears to be of particular importance in the case of the porous red volcanic soils.

A useful method of adding a certain amount of organic matter to a pasture soil is to permit the grass to grow tall and rot down once in every three years or so.

Conservation.—The conservation of surplus pasture growth for feeding to stock in lean periods is of particular importance in coastal districts, where the difficulty of conserving hay on the farm is acute. Paspalum pasture is very suitable for silage-making purposes, and on well-managed farms the conservation of the excess growth fits into the general farm management. The grass should be cut when in early flower; and, if ergot disease is present, cutting prior to the formation of hard ergots is advisable in order to minimise the danger of poisoning stock fed on the silage.

Feeding Value.—Paspalum is a very palatable grass and is relished by all classes of live stock. The grass has its maximum value for cream production when in the young, leafy stage, and the pastures should be so managed that they are always grazed off in their most nutritive stage.

Pests and Diseases.—The major pest of paspalum in Queensland is the white grub, which causes very serious damage to paspalum pastures on the Atherton Tableland. The grubs are the larvæ of a beetle; and,

if present in sufficient numbers, may ruin a pasture by destroying the underground portions of the plant. Remedial measures are at present being investigated, and farmers in the infested area are advised to procure pamphlet No. 33 of the Division of Entomology and Plant Pathology, Department of Agriculture and Stock, entitled "White Grub Damage to Pastures on the Atherton Tableland," by J. Harold Smith.

The fungus (*Claviceps paspali*) causing ergot in paspalum first appeared in epidemic form in Australia in 1935, and its widespread occurrence has been responsible for serious losses in stock and in dairy production. Details of the life history of the fungus, and of its effect on stock, are contained in separate departmental leaflets, which are available to farmers on request.

Undesirable Features.—In addition to that susceptibility to ergot, paspalum has the disadvantage of being somewhat of a pest on cultivated land. It establishes itself on fallow areas, in lucerne paddocks, &c., from seed transported by various means, and is rather difficult to eradicate.

Kikuyu Grass (*Pennisetum clandestinum* Hochstetter).

Origin and Distribution.—Since its introduction from Africa to Australia in 1919 Kikuyu grass has found considerable favour as a pasture grass for dairy cattle, chiefly in areas of summer rainfall. Because of the failure of the Australian material to set seed, Kikuyu grass has not been so spectacular a success as paspalum or Rhodes grass; yet it is a valuable adjunct to standard dairying pastures throughout Eastern Queensland.

Description.—Kikuyu grass is a summer-growing perennial grass which, under suitable conditions, spreads rapidly over and through the ground by means of running stems. Both the surface runners and the underground stems root freely at the nodes, anchoring the plant firmly in the ground and forming a dense turf which withstands heavy trampling by stock and "rooting" by pigs. The creeping and erect stems carry a large quantity of leaf, and the stems themselves are very succulent. Under favourable conditions, Kikuyu grass makes a very dense growth, often as much as 2 feet in height.

Climatic Requirements.—In Queensland the grass has adapted itself fairly readily to varying climatic conditions. It does best under moist, sub-tropical conditions; but will withstand a considerable amount of cold and remains green in spite of fairly heavy frosts. For this reason it is very valuable for late autumn and early winter grazing. Its drought resistance is fairly good and some success has been obtained on the Darling Downs and throughout the coastal river valleys (Burnett, Brisbane, Fassifern, Logan, &c.). At present it is used chiefly in the moist dairying districts as an alternative or as a supplement to paspalum. Its lower limit of average annual rainfall is about 27 inches.

Soils.—Kikuyu grass spreads most quickly and yields most grazing on loose, rich soils well provided with moisture, and while it may and does provide fair grazing on some less fertile soils of a sandy or clayey nature, a long-lived high-producing stand can only be assured if the grass is planted on fairly rich soils. Kikuyu grass draws heavily on soil nutrients, especially nitrates, and periodical ploughing to improve the soil conditions is desirable. Under special circumstances, the grass is recommended for poorer soils, such as in rough places or as a soil binder to prevent soil erosion.

Planting.—Whilst in some seasons Kikuyu grass flowers freely in Australia, seed is set very sparingly indeed and commercial supplies are not obtainable from that source. Propagating material is obtained by dividing the crowns of well-rooted plants, by cutting the rooted runners into sections, or by making cuttings of the erect stems. Each planting slip need be only a few inches in length but must have one or two nodes. Planting should be carried out during spring or summer. Cultivable land should be ploughed and harrowed and the cuttings planted 3 feet apart in drills run out a similar distance apart. The cuttings are best covered by hoeing earth on to them, leaving about one-third of the length of the cutting protruding from the soil, and the soil is firmed about each cutting by tramping. If a paddock is carrying only a light covering of grass, some farmers give it just a shallow

Plate 100.
Kikuyu grass.

ploughing and plant cuttings in each third or fourth furrow as the ploughing proceeds. This procedure is not desirable on any but the best soils; on medium-class soils it is preferable to build up the soil fertility before planting Kikuyu grass. The grass is often planted for special purposes, such as weed control or erosion control on rough country. The most practicable method of planting is to mattock the cuttings in and tramp the soil firmly around them.

Despite the very vigorous nature of the growth of Kikuyu grass, white clover is able to persist and thrive in association with the grass where soil and climatic conditions are suitable; and seed of white clover should be planted in Kikuyu paddocks on coastal scrub soils.

Management.—Good management of Kikuyu grass pastures involves intermittent grazing and periodical renovation. Judicious grazing, the scattering of manure and the stimulation of clover development, together

with an annual disc harrowing or renovation with a paspalum renovator, will serve to keep the grass from becoming sodbound. If these measures are neglected the pasture will mat and ploughing will be necessary to give fresh life to the grass.

Conservation.—Kikuyu grass is very difficult to cut with the mower and difficult also to cure, so it is not well suited for conservation.

Feeding Value.—The palatability of Kikuyu grass is excellent and its feeding value is of a high order. The leafy portions of the plant, of course, are of the highest feeding value, and the pasture must be managed so as to keep the grass fairly short for the grazing animals. All classes of stock do well on Kikuyu grass pasture and the grass is particularly useful for pig pastures.

Special Uses.—Being a vigorous, smothering plant, Kikuyu grass is useful for planting in bracken-infested country. In addition to retarding the development of the bracken, it encourages stock to work in amongst the fern and trample it down.

Undesirable Features.—Though a valuable pasture grass, Kikuyu grass is liable to become a very troublesome weed if permitted to encroach on cultivation areas. For this reason it should not be planted adjacent to areas likely to be required for cultivation. In wet weather, portions of the grass are often broken off by grazing animals, and such pieces may be carried by the animals' feet to other portions of the farm and become established after having been trampled in. Whenever patches which have commenced in this manner are discovered in proximity to cultivation paddocks, they should be eradicated.

Molasses Grass (*Melinis minutiflora* Beauv.).

Origin and Distribution.—Molasses grass was introduced to Queensland over thirty years ago from tropical South America. It is a native of Africa and is said to have reached South America during slave-trade days. In Queensland it is grown extensively along the tropical eastern coastlands and to some extent on the Atherton Tableland.

Description.—Molasses grass (Plate 101) is a perennial grass of straggling habit, each tuft forming a large number of trailing stems up to five feet long and reaching a height of two feet or more. Under suitable conditions it is a very rapid grower, spreading quickly by means of the creeping stems and smothering out other growth by the dense mat which it forms. The ability of the grass to cover a cleared area quickly, to the exclusion of weeds, makes it very valuable for sowing on burnt-over areas on which weeds usually come away very quickly. Molasses grass has a strong and distinctive smell, due to the presence in the foliage of a volatile oil. In addition, the leaves exude a sticky secretion which is reputed to be repellent, and perhaps fatal, to ticks and mosquitoes. Four forms of the grass occur in Brazil—namely, "red," "white," "negro's hair," and "francano." Of these, the commonest form grown in Queensland probably is the red.

Climatic Requirements.—The areas to which molasses grass is best suited are the coastal districts north of Rockhampton—that is, the wet tropical region. It stands up to dry weather quite well, but in cool districts it is badly affected by frosts.

Soil Requirements.—Molasses grass does not demand particularly rich soils and does fairly well on forest soils in North Queensland. Even on dry and somewhat infertile soils it is of some value.

Plate 101.
A plant of molasses grass.

Planting.—The seed of molasses grass is extremely light, and if seed of good quality is used a seeding rate of 2 to 4 lb. per acre is ample in most cases. The germination capacity of a large proportion of the commercial seed of molasses grass is not particularly high and a 20 per cent. standard is set by the Pure Seeds Acts. The seed should be sown during spring or summer, either on scrub burns or on cultivated land. Broadcasting by hand is perhaps the best method of distribution. Instead of seeds, stem cuttings may be planted, but the sowing of seed is much less costly.

Molasses grass is generally sown alone, but the addition of from ½ to 1 lb. of seed of Townsville lucerne per acre probably would improve the pasture in many instances.

Management.—Molasses grass has its growing buds above the ground and is consequently unsuited to heavy, continuous grazing conditions. It should be sown in relatively small paddocks and spelled at intervals in order to permit of recovery from the intermittent grazings.

Conservation.—In South America molasses grass is often conserved as hay or as silage, but so far little or nothing has been done along similar lines in Queensland.

Plate 102.
A molasses grass pasture.

Feeding Value.—Stock at first show a distinct distaste for molasses grass; but, in North Queensland at least, they soon grow accustomed to it and eat it readily enough. Its nutritive value appears to be only moderate for dairy cows, though stock fatten on the grass quite rapidly.

Seed Production.—The poor quality of much of the molasses grass seed on the market may be attributed in part to too early harvesting and heavy threshing. The grass should not be cut for seed until a fair proportion is ripe; and the seed which falls when the cut plants dry will be of good quality.

Pests and Diseases.—No trouble from pests and diseases has been experienced in Queensland.

Giant Panic Grass (*Panicum antidotale* Retz.).

Origin and Distribution.—Giant panic grass, known also as blue panic grass, is native to Southern Asia, and was introduced to Australia many years ago. It is at present grown on small areas in Northern New South Wales and in Southern Queensland. Tests in progress indicate that the grass is likely to find a useful place on grazing properties from the coast to the interior.

Description.—Giant panic grass (Plate 103) is a tufted grass with an exceptionally vigorous rooting system, and forms short, strong

underground stems from which are produced succulent leafy shoots that eventually may develop into cane-like flowering stalks. The underground runners and deeply-penetrating roots enable the grass to withstand heavy feeding and to survive dry conditions.

Climatic Requirements.—Whilst it thrives under fairly heavy summer rainfall conditions, giant panic grass is especially adapted to areas receiving an average annual rainfall of 20 to 40 inches. In such areas it responds well to storm rains during the summer and during the dry autumn remains green longer than most grasses. Heavy frosts cut the grass back, but light frosts do not interfere to a great extent with the production of green shoots from the joints of the stems.

Soils.—Giant panic grass is modest in its soil requirements, being able to thrive on a great variety of soils, ranging from sandy loams to stiff clays. Naturally, it does best on fairly fertile soils.

Plate 103.
Giant panic grass.

Planting.—The grass seeds freely and the seed is of fair germinating capacity. The minimum percentage of germinable seed desirable in commercial seed is 40, and better lines should be obtainable. The seed is small and light, and from 4 to 6 lb. should suffice to seed an acre. The seed may be broadcast by hand or machine, or drilled in, and should be lightly covered. The best time to sow is in the warm months, as the seedlings then become quickly established. The land should be cultivated if the seed-bed is not a fresh scrub burn. The grass can be established readily by means of rooted divisions of the tufts. Since it is as yet only employed on a small scale, giant panic grass is usually sown in a pure stand.

Management.—The management of giant panic pastures should aim at preventing the development of canelike stems, which are of inferior feeding value. The production of basal shoots of high nutritive value should be encouraged by intermittent grazing, which also will serve to restrict the tendency of the plant to grow rank.

Conservation.—It is difficult to obtain a heavy cutting of giant panic grass without including a high proportion of coarse, stemmy material; consequently, the grass is not likely to prove of much value for hay or silage-making purposes.

Feeding Value.—The feeding value of giant panic grass is fairly good, but the nutritive value of a grass is at its highest when the plant is in the young leafy stage, and giant panic should be kept eaten down to prevent the formation of canelike stems. This suggests that the grass should be sown in small enclosed areas upon which stock may be concentrated in numbers sufficiently large to ensure that the grass is eaten at the correct stage.

Seed Production.—Seed is set in fairly large quantities and may be harvested by hand.

Pests and Diseases.—None of its natural enemies cause much trouble to giant panic grass.

Undesirable Features.—An objectionable feature of giant panic grass is its tendency to spread on to areas on which grazing cannot be rigidly controlled, with the consequent danger of production of thickets of the grass to the detriment of grazing areas originally carrying finer grasses.

Guinea Grass (*Panicum maximum* Jacq.).

Origin and Distribution.—A native of Africa, Guinea grass is now naturalised in most wet countries within the tropics, and is used extensively for forage purposes in South America, the West Indies, Africa, the East Indies, South-eastern Asia, &c. It has been established in Queensland for many years and is fairly common under wild and, to a lesser extent, cultivated conditions along the coastal strip.

Description.—Though many different forms of the grass may be recognised, it generally occurs in large tufts from two to five feet in height and does not form a close turf, as do the better-class pasture grasses (Plate 104).

Climatic Requirements.—As may be gathered from a perusal of the list of countries in which it is important, Guinea grass thrives under warm, moist conditions. Its season of growth coincides with the summer wet season and during dry periods it is unproductive. Severe frosts weaken the grass or kill it and its use should be confined to areas free from heavy frosts.

Soils.—In its native country, Guinea grass is found on a wide range of soil types, and in Queensland it is found on railway embankments and on inferior soils as well as on rich country. For pasture purposes its use should be confined to fertile types of soil.

Plantings.—Guinea grass produces numerous seedheads which flower profusely. Little viable seed is set, however, and ripening is uneven. Much of the seed collected, consequently, is of poor germinating capacity and is almost worthless. The only reliable means of

propagating the grass is by planting out rooted pieces of the crowns. These should be set out, spaced two feet apart each way, when rain falls in spring or early summer.

Management.—In most countries in which it is grown Guinea grass is cut and fed to stock in the green state; but, if it is used in small paddocks and grazed intermittently, the trampling of stock should do the pasture little harm.

Plate 104.
Guinea grass.

Conservation.—Guinea grass makes an excellent hay if cut at the flowering stage. The chief difficulty associated with haymaking is the tufted nature of the plant, which often makes mowing difficult.

Feeding Value.—The grass is very palatable to stock, and the young growth has a high feeding value. Nutritive feed is provided also by Guinea grass hay and silage cut at the right stage.

Seed Production.—The unreliability of Guinea grass seed, other than hand-picked material, is a deterrent to the collection of commercial seed.

Undesirable Features.—In various parts of the world (including Queensland) Guinea grass specimens examined for cyanophoric-acid-yielding glucosides have given positive results, but the amount of prussic acid developed probably is insufficient, under normal grazing conditions, to poison stock.

Elephant Grass (*Pennisetum purpureum* Schum.).

Origin and Distribution.—Africa is the native home of elephant grass or, as it is known in most countries, Napier grass. It now is fairly common in various sub-tropical and tropical regions of the world, including South America, the Southern States of America, West Indies, East Indies, and Hawaii. It was introduced to Australia in 1914 and is now used to some extent in New South Wales and Queensland.

Description.—Elephant grass (Plate 105) is a canelike grass usually reaching a height of 7 or 8 feet, but occasionally growing much taller. It forms large tufts which tiller very freely. The main stems at maturity are extremely coarse and hard, but a large amount of palatable leaf is produced and, if the plant is grazed or cut at the correct stage, the hard stems do not develop.

Climatic Requirements.—Though the tropical coast is the most suitable area for elephant grass, it does quite well in many sub-tropical areas and is grown successfully in a large portion of Eastern Queensland. Its growing period coincides with the summer rainy season and little development is made during the winter months or during dry periods in the summer. The grass is very drought-resistant, and quickly produces feed after the breaking of the dry spell. The foliage is injured by frosts, but the underground parts are not damaged seriously.

Soils.—In common with all other heavy-producing grasses, elephant grass requires fertile soil conditions for its best development. Whilst it will produce feed on inferior soils, it is essential that fertile soil conditions should be provided if abundant feed is to be produced. Well-drained alluvials, scrub volcanics, and rich sandy loams are the best types of soils to use.

Planting.—Elephant grass sets seed very rarely in Australia, and the only material available for planting is the stem cuttings or crown divisions. These should be planted during the summer on well-prepared land. The stem pieces used should be cut from hard stems about six months old and each cane should possess four or five nodes. When planting material is abundant the stems can be cut into three-feet lengths and laid end to end in furrows. When cane pieces are used the furrows should be run out about four feet apart, and three or four inches deep, and the canes laid horizontally in the furrow and covered with soil. When root clumps are broken up for planting the pieces should be planted in hills about two feet apart in the row. After it has been planted the grass should be cultivated until it has become well established.

Management.—In most instances where elephant grass is grown on a farm, the area of the stand is very small and the crop usually is cut and fed green in the same way as maize and sorghum. The first cutting is made about three months after the time of planting, when the stems

are four or five feet tall. The plant recovers quickly after having been cut, and three or four cuttings may be obtained in a season. Stems which appear to contain a high percentage of fibre should be chaffed before being fed.

Plate 105.
Elephant grass.

Within recent years extensive grazing areas of elephant grass have been established in Hawaii, and the grass is said to have shown its value definitely as a pasture grass when grazed intermittently. It is estimated that, under suitable growing conditions, one mature head of beef cattle per acre per year can be fattened on the grass.

Conservation.—Elephant grass is in some countries cut for silage, but the forms grown in Queensland appear to be somewhat too woody for this purpose when in the growth stage at which a bulk comparable with that obtainable from sorghums would be available.

Feeding Value.—The feeding value of elephant grass cut in the immature stage compares favourably with that of Sudan grass in respect to protein and minerals, and, as a heavy yield of immature grass can be obtained, elephant grass provides a large bulk of nutritious feed.

Seed Production.—Seed is set occasionally but not profusely enough to warrant collection, particularly as the plant may be propagated quite readily from cuttings, &c.

[TO BE CONTINUED.]

THE APIARY.

With the opening of the earliest spring flowers and the accompanying rise in temperature, the bees begin to collect the small amounts of nectar and pollen thus provided. As the weather becomes warmer the supplies rapidly increase, and the bees are stimulated greatly to build up the colony. Brood-rearing begins as soon as the new supplies come to the hive, and as the first bees emerge they in turn increase the capacity of the colony for brood-rearing, so that with a good queen and other favourable conditions the amount of brood is increased rapidly.

The main object of the work in the spring is to ensure an abundance of bees in time for the coming honey flow, but during early breeding the bees should be disturbed as little as possible. In order to ascertain whether the bees have sufficient stores, the weight can be judged by tilting or lifting the hive, or the size of the cluster may be ascertained, without breaking the propolis which seals the cover, by looking at the combs from below.

On the first examination, which should take place when all danger of frosts is past, the beekeeper should look especially for queenless colonies. If any are found, it is best to unite these with normal colonies if queens are unobtainable. When uniting, two weak colonies should not be placed together, but a weak colony may be united with a strong one. If desired, the number of colonies can be restored later on, by subsequent division. The beekeeper should also examine the stores, for bees require large amounts of food during the spring, and, while they usually obtain considerable nectar outside, it is rarely enough to provide stores for the very rapid rate of breeding that takes place at this time. If food is needed it may be given rapidly in the form of thick sugar syrup, or, what is even better, combs of honey may be provided.

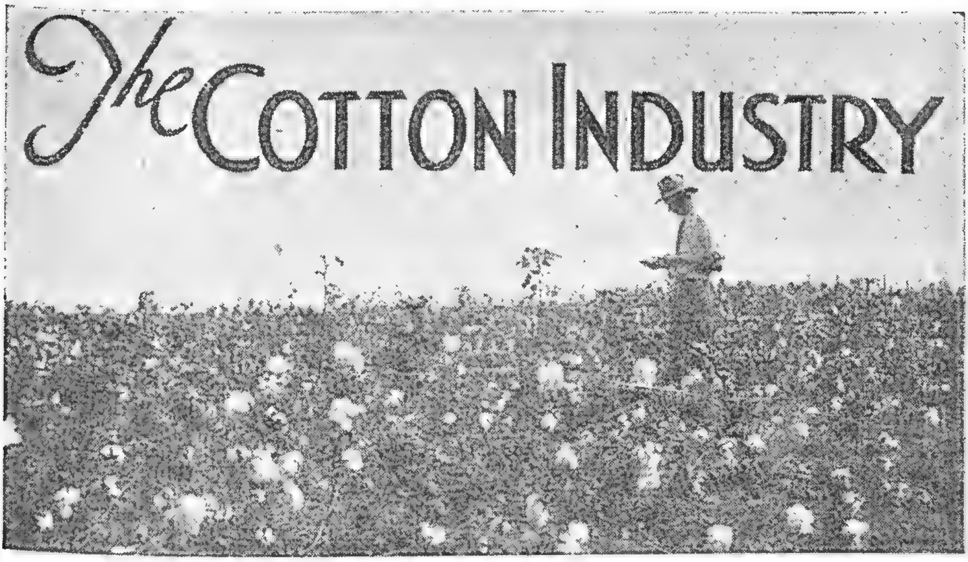
For those who are desirous of increasing their apiaries, this is a good time to purchase additional colonies. Although the prices asked at this time of the year are higher, usually, than those ruling in the autumn months, they may be expected, during normal seasons, to bring in an immediate return.

If it is intended to move colonies of bees to a different site, this is best done during the cooler months. A special ventilated cover is not necessary then owing to the bee population being less numerous, moreover, winter is the bee-keeper's slack period.

To move bees successfully, however, some preparations are necessary. All supers containing honey should be removed from the hives and carried separately, leaving only sufficient honey with the bees to see them to the journey's end. If the frames are self-spacing it is necessary merely to crowd them together and insert two wooden wedges between the outside frame and hive wall. With unspaced frames a pair of notched strips of wood must be cut for each colony. The sticks preserve the essential distance between each frame and in this way prevent crushing the insects. Two 1-inch nails will secure each stick in place at the ends of the frames. The bottom boards and hive covers should be secured with staples driven in the sides and back. One leg of the staple must be driven into the edge of the bottom board or cover as the case may be, and the other into the hive-body. At the close of the day, when the bees are all in, a narrow strip of wire cloth should be bent to a right angle lengthwise and tacked across the entrance so that it is closed securely.

For road travelling, hives should be packed on the motor truck so that the top-bars of the frames are parallel with the axle, as the combs resist the side rocking of the vehicle much better in that position.

H. Hacker.



Cotton Culture.

W. G. WELLS, Director of Cotton Culture and Senior Research Officer.

ALTHOUGH cotton has been grown commercially in Queensland at different times since 1860, the present period of cotton growing originated about 1920 under a system of Federal and State Government guaranteed prices, which induced farmers to try this crop over a wide range of soils and climatic conditions. Many failures resulted, of course, through lack of experience, but it was demonstrated clearly that excellent yields of good quality could be produced over much of the south-eastern portion of the State. Broadly speaking, the most promising results were obtained in the districts lying between the Great Dividing and the coastal ranges, and extending from Beaudesert in the south to the Fitzroy River and adjacent areas in the north, an area of roughly 400 miles long and from 50 to 100 miles wide.

Cotton now has been grown on an extensive scale in these districts for a considerable time, during which a range of climatic and rainfall conditions, varying from the driest season in sixty years to the wettest winter and spring in a similar period, has been experienced. An excellent opportunity thus has been presented to test it under very extreme conditions, and it has been demonstrated that cotton is a very suitable crop for many sections of the south-eastern portion of the State. In fact, it appears to be the most profitable cash crop that can be grown on many soils in most of the districts, and in several of the drier areas it is outstandingly the best.

PRODUCING COTTON.

Although cotton has been demonstrated to be very suitable for many districts, it is not considered advisable to concentrate on growing it under a one-crop system. Like every other agricultural crop, it is subject to failure, and investigations also have shown definitely that growing cotton year after year on the same soil is conducive to diminishing yields. It is recommended strongly, therefore, that cotton be grown in rotation with

fodder and grass crops. As dairying is well established in most of the cotton districts, such crops can be utilised to good advantage. Broadly speaking, it appears desirable especially in the drier areas, that farmers in the sections where cotton can be grown profitably should develop a cropping system whereby cotton will be the main cash crop, and dairying will be engaged in sufficiently to utilise the fodder and grass crops that have to be grown to keep the soils in the proper condition to produce high yields of cotton.

SUITABLE SOILS.

Variations of climate in a season and between seasons make it most difficult to obtain annually the maximum yield of which a soil is capable. It is believed, therefore, that the farmer should endeavour to ascertain the soils on his place which will produce good yields of cotton in several successive seasons rather than the soil which will produce a very high yield in one season and possibly a poor one in another. The cotton section of the Department accordingly has endeavoured to ascertain the soils in each district which will produce good yields under a wide range of climatic conditions, and, generally speaking, it appears that the clay loams overlying a clay subsoil at a depth of one to three feet approach the nearest to this ideal. Grouped under this soil type may be classed the slopes originally under ironbark, in some districts the broad leaf and in others the narrow leaf ironbark being used as the indicator; the lower slopes and flats associated with box trees of good size; the scrub soils of the brigalow series, especially if adjacent to lower slopes originally covered with box or ironbark; and also the brigalow-belah scrub mixture, if not of so low a level as to become waterlogged in a wet season. These soils appear to be very suitable for cotton growing, for in a dry season the clay subsoil holds the moisture up to the lateral and tap root system, while in a very wet season they become partially waterlogged, and therefore retard plant growth sufficiently to prevent excessive development, and yet not restrict the plants too much.

Other soil types which will produce good yields of cotton, but are more subject to crop fluctuations caused by climatic variations, are the rich loams and clay loams of the alluvial flats usually originally covered with blue gums and a mixture of blue gums, Moreton Bay ash, narrow leaf ironbark, and bloodwood. Of these soils the heavier clay loams associated with blue gums, especially if mixed with large box trees, appear to be the most reliable, although on all of them, if properly rotated with grass crops, excellent yields of cotton of good quality can be obtained.

UNSUITABLE SOILS.

The most unsuitable soils appear to be the deep red soils of the soft vine scrub series and the deep sandy loams of the river and creek alluvials. Cotton crops on both types usually are seriously affected by dry conditions and high temperatures owing to the requisite moisture content dropping to levels below the main lateral root system of the plants. Shedding occurs when this happens, and if heavy rains are experienced afterwards excessive growth generally develops, which is often severely attacked by various insect pests, and frequently no yields are obtained. Farmers should study the suitability of their soils very carefully. In some districts, where at first it was thought cotton could not be grown successfully, profitable cotton crops are now obtained, simply by changing over to other soil types which, fortunately, occur on nearly every farm.

Plate 106.

A portion of a 100-acre field in the Callide Valley, Central Queensland, which averaged over 1,500 lb. of seed cotton per acre. Thousands of acres of forests have been cleared in this and other districts of Central and Southeastern Queensland for cotton-growing since 1924.

NEW CULTIVATION EFFECT.

Observations on all soil types throughout the cotton districts have shown that cotton, during the first two or three seasons following the first cultivation of newly broken-up grassland, has produced heavier yields of lint usually than adjacent cultivations on which cotton has been grown successively for a number of years. The explanation appears to be that a better balance of plant food and also much greater penetration of rain, especially storm rains, is obtained in the newer cultivations.

The continuous cultivation of row crops, such as cotton, causes the rapid decomposition of the original organic matter in the soil, consisting of grass roots and stalks, leaves of trees, &c. This decomposition is accompanied by a rapid increase in the readily available form of nitrogen called nitrate nitrogen, which is the product taken up by the plants. Within four years of cultivation after the breaking-up of the grassland the nitrate content of many of the more fertile loams and clay loams of the alluvials and softwood scrubs increases so much in mid-season that the actual contents of the plants, particularly late-sown ones, become so unbalanced as to affect the fruiting habits of the plants, especially in seasons with light rainfall in the spring and early summer, and heavy mid-seasonal rainfall. On fertile alluvial clay loams the initial nitrate content of new cultivations is often only 7 to 15 parts per million parts of soil, while with several seasons of cultivation of cotton crops it rises to 40 and sometimes as much as 60 parts per million.

The decomposition of organic matter which brings about this increase of supply of nitrates seriously affects the pore space of the upper soils. Investigations have shown that in the soils of a nine-year-old cultivation the total amount of carbon is reduced, a unit volume of soil weighs more, the absorption of moisture is decreased, and the surface soils become more compacted, thereby lessening the penetration of storm rains. In one experiment at the Cotton Research Station, following a steady beating storm of 2·46 inches lasting over twenty-five hours, it was ascertained that only 35 per cent. of the rain penetrated in the upper 18 inches of soil in a nine-year-old cultivation in cotton, as compared with 74 per cent. in a two-year-old cultivation in cotton. As the mid-seasonal rainfall is often of a severe beating nature, it is obvious that the cotton crops on the older soils do not receive the fullest possible benefit from such storms.

Studies made of the movement of the nitrates indicate that the more open surface of the newer cultivations may be of decided advantage in respect to the nitrate absorption by the cotton plants. The bulk of the large lateral root system of a cotton plant on the clay loam soils occurs usually in the first 7 inches of soil. As the nitrates are manufactured in this zone, it follows that in an open soil a greater washing-down of the nitrates occurs with the better penetration of the rains. The nitrate content of the soils around the main lateral system therefore would be reduced more often in the newer cultivations in a wet season, which would tend to bring about a better balance of plant food and thus cause the plants to make less rank growth and fruit more heavily.

CROP ROTATIONS.

Obviously new cultivations cannot be brought in continuously, hence it is necessary to ascertain the system of rotation that will keep the soils in a state best suited to the production of high yields of cotton. Rotation experiments carried out at the research station over a series

of years indicate that some gain can be obtained by growing cotton alternately with giant setaria (giant panicum), maize, sorghum, and such fodder crops. Indications have also been obtained that possibly better yields will be produced where cotton is grown following two fodder crops. Another rotation that is proving most successful is one in which Rhodes grass is grown for three seasons on old cotton land, after which cotton is sown for two or three seasons, depending on the fertility of the soils. Analyses of soils where such a rotation has been practised have shown that Rhodes grass reduces the nitrates substantially during the first two years of growth. Illustrations of the suitability of this rotation on scrub soils have been seen in all districts, and it is recommended strongly that all growers test out the value of a Rhodes grass-cotton rotation on their soils. The food value of the Rhodes grass is high for dairy cows, and, in addition, there is less labour involved in growing it for three seasons than would be required for three ordinary fodder crops.

Plate 107.

ROTATE RHODES GRASS WITH COTTON.—The four or five year old unstumped Rhodes grass paddocks should be brought into cultivation for growing cotton. Excellent yields of cotton are obtained on this class of heavy brigalow scrub soil. After three years of cultivation heavy growth is produced in the resowing of Rhodes grass.

Whatever programme is finally followed, it is necessary to have some rotation of crops if the cotton yields are to be profitable. The soil must be kept in the best condition for cotton growing, otherwise highly varying yields caused by seasonal variations and insect attacks, are certain to be obtained. In addition, the rotation of grass and fodder crops with cotton will help materially in controlling weed growth, and thus reduce the cost of production.

SIZE OF AREAS.

At present the area of cotton per farm varies from 1 to 150 acres, with the average ranging from 5 to 10 acres for the smaller farms to 30 and 40 for the larger ones, also a good sprinkling of 60, 80, and 100-acre crops. The most suitable area depends entirely on the system of farming which is followed. When grown in conjunction with dairying the size of the herd and the amount of labour available should decide the acreage

of cotton. The degree of freedom from weed and grass growth also regulates the area—it being much easier to maintain clean tilth on new cultivations than on areas which have been cultivated for years. Generally speaking, the acreage of cotton should be limited to one that can be kept clean and well cultivated under normal conditions.

Where successful results have been obtained regularly it is recommended that the fullest amount of cotton that can be taken care of properly shall be grown, for undoubtedly cotton can yield better returns per acre under favourable conditions than most farm crops. The main point is to select the most suitable soil each season and to plan a system of crop rotations so that there is always an available area in the best condition for cotton growing. Where this system is followed there will be fewer crop failures, the average yield per acre over a series of seasons will be higher, and the cost of production will be less. A greater degree of stability of the whole industry will also be obtained, which is highly important, for a wide fluctuation in the total yield from season to season increases the difficulties of financing, ginning, and marketing.

EQUIPMENT.

When cotton growing was revived in 1920 the crop was produced mostly in the older settled districts where the farms were generally equipped with walking scufflers, one-row planters, and the usual equipment of the small mixed farm. With the expansion of the industry into the newer settlements with larger acreages of soils suitable for cotton, the areas planted by individual growers quickly increased. These growers purchased riding cultivators, two-row planters, three-section harrows, two or more furrow ploughs, &c., and the acreages farmed with such equipment have demonstrated amply how its use lowers the cost of production. It is believed that there should be a more general use of this type of equipment in the older areas, especially in the dairying districts where between the milkings there is only a limited time for farming operations. This is especially true of the wiggle tail type of riding cultivator, with which one man can cultivate 7 to 10 acres a day, as compared to 3½ to 4 acres with the walking scuffler, and, in addition, can do more efficient work, thereby eliminating the necessity for the hoe being used for other than thinning the cotton crop and chipping out odd patches of weeds.

The use of the two-row split-wheel type of combination maize and cotton planter equipped with disc openers is also of decided advantage. A man with a one-horse single-row planter can plant from 4 to 6 acres a day, whereas with a two-horse two-row planter he can plant 10 to 14 acres a day, depending on the speed of his horses and the length of the rows. This is of marked advantage, as over the bulk of the cotton area the spring rains are precarious and frequently planting has to follow a fall of 50 to 60 points of rain. Speed, therefore, is a big factor in obtaining a good germination under such conditions, and the quicker planting is performed the greater the likelihood of success, especially under the drying-out conditions which usually prevail during spring.

Another decided advantage obtained by the use of this type of planter is that the planting is effected more uniformly than with some of the combination planter-cultivators on the market. Having the planting spouts with disc openers just ahead of the wheels tends to insure the spout and the wheel being more in the same plane than where the spout is some distance from the wheel, as in the other types

mentioned. The split-wheel appears to be of the utmost importance where planting is effected following a storm of some 50 to 60 points of rain. The packing action of the rims of the wheel on the sides of the seed rather than on the top insures the seed being in firm moist soil and at the same time leaves a loose mulch on top to reduce evaporation. As the weight of the machine and the driver is borne by the rims which press the soil against the sides of the seed, it can be seen that a decided firming of the seed-bed directly under the seed is also accomplishd, which assists in making contact with the moisture of the subsoil.

Where the acreage to be planted is too small to warrant the purchase of a two-row machine, the grower may secure very good results with some of the single-row split-wheel planters. These machines utilise the same principle in covering the seed, but may be somewhat light for obtaining the same pressing effect around the seed. This can be effected by carrying a partly-filled sack of seed on the back part of the frame.

PREPARATION OF SEED-BED.

The variation of the winter rainfall is one of the biggest problems with which the cotton-growers in this State have to contend. It is of the utmost importance, therefore, that the Queensland cotton-grower should follow the most suitable methods of preparation of the seed-bed. In seasons of good winter and spring rainfall successful results are often obtained with indifferent methods, but over a series of seasons it undoubtedly pays to prepare the seed-bed so as to store up the maximum possible amount of subsoil moisture.

The general results obtained by farmers in all districts and at the cotton research station amply demonstrate the value of preparation of the seed-bed before the occurrence of the usual June rains, or as soon thereafter as possible and before the benefit of the wetting of the surface soils has been lost. In experiments at the research station over a series of seasons it has been shown definitely that a gain of moisture equivalent to at least an inch of rain is obtained in the upper 18 inches of soil, simply by ploughing ahead of the June rains instead of late in July and August. Ploughing before June can seldom be done following cotton, however, and this indicates the advantage to be gained by growing cotton in rotations with crops which can be harvested in time to allow early ploughing.

Where cotton is to follow cotton it is strongly recommended that the old cotton stalks be cut off with a slide cutter (plates 3 and 4) similar to that used in cutting green maize. This machine can be made on the farm and requires only a wooden V-shaped slide and two worn-out crosscut saws. These are ground to a knife edge and holes bored through for bolting the blades to the slide. The bushes should be cut right behind the pickers and then raked up to dry and burn as quickly as possible, after which ploughing should start promptly. In this way the winter rains may be conserved to a marked extent, especially if the ploughed land is cross disc harrowed, as this operation firms the bed and yet leaves it in a good condition to absorb the maximum amount of moisture at the occurrence of the planting rains.

Some growers have practised ploughing under the old stalks, but unless this is done early or rather deeply, an open seed-bed exists at planting time which requires more rain than where the stalks have not been ploughed under. The ploughing under of so much easily

Plate 108.

SLIDE CUTTER.—An adaptation of the old-fashioned maize cutter, for cutting cotton plants. The box at the rear is a guard over two rolling coulters, which serve to steady the machine so that it cuts more efficiently.

Plate 109.

REAR VIEW OF SLIDE CUTTER.—Showing the method of attaching the rolling coulters. These are of decided assistance in steadying the machine, which has a tendency to swing from one row to the other owing to the irregularity of the spacing of the plants.

NOTE.—After the photograph was taken, it was found that a 6-foot blade, instead of three sections of saws, gave better results. Width of saws should clear frame by 3 inches.

Dimensions of machine are as follows:—Length, 10 feet; width at widest point, 7 feet; width of back carriage, 3 feet; length of arms, 8 feet 6 inches; framework, 4 inches by 3 inches (hardwood).

decomposed vegetable matter, especially on fertile alluvial soils, also increases the nitrate content of the soils, and in some districts has enriched them to such an extent that all varieties of cotton tried in recent seasons have made rank growth and failed to produce profitable yields.

Another reason why it is not advisable to plough under the stalks in the Upper Burnett and Central districts is that the pink boll worm attacks the late crop of bolls rather heavily in some seasons. These bolls develop boll rots and are not picked, so the pink boll worms are turned under with the ploughing in of the cotton stalks. Investigations in Egypt have shown that ploughing under bolls containing pink boll worm does not kill the worms, even if the fields are irrigated. In this respect it is advisable to turn the dairy herd into the cotton fields as soon as the crop is harvested, for the cows eat a remarkable lot of the small unpicked bolls and old bolls containing tufts of cotton and diseased locks, thus destroying a considerable amount of insect life.

On new country, or in the first few seasons following Rhodes grass, it does not appear to be so necessary to plough early, as apparently the more open nature of the soil allows of a greater penetration of the June rains. Undoubtedly greater attention should be paid, however, to obtaining early well-prepared seed-beds on old cultivations, for each season considerable acreages are lost, or stands of cotton seriously reduced, through lack of subsoil moisture, although there was ample winter rainfall to supply the same.

DEPTH AND NUMBER OF PLOUGHINGS.

The depth and number of ploughings varies with soil type and climatic conditions. Generally speaking, with the exception of breaking up new cultivations, one ploughing from 5 to 6 inches deep seems to be suitable in most districts. On some of the heavier clay or clay loam soils which tend to set very hard if much winter rainfall is experienced, it is advisable to cross plough early in the spring to loosen up and warm the seed-bed if winter rains have fallen. Late cross ploughing should not be practised if it can be avoided, however, for a lot of moisture is lost with the operation, and in a spring with light planting rains the dry surface soil turned under with the late cross ploughing may not be wet sufficiently to carry the young seedlings through dry spells. Many losses of stand were experienced in the earlier years of this present period of cotton growing, simply because the farmers practised the usual deep ploughing and cross ploughing used in preparing seed-beds for potatoes, sugar-cane, &c. In later years one ploughing of 5 to 6 inches has become more general, and less loss of stand occurs from lack of subsoil moisture.

In general, it is most advisable to plough across a slope on the level contour rather than in a straight line across it or up and down the slope. Studies made in the Callide Valley have shown that contoured ploughing on slopes in the second year after grassland traps all storms recording not over an inch of rain.

FERTILIZERS.

Experiments testing the value of different fertilizers have been carried out over a series of years in different districts and on various soils, but, generally speaking, there has been no clear-cut evidence that there is any economic gain to be realised by using them. The

explanation is not clear, but it is suspected that the limited and variable spring and early summer rainfall is responsible for the lack of results from the tests. Similar results have been obtained in parts of East and South Africa, where the climatic conditions are comparable with those in the cotton areas here.

In some seasons the addition of nitrate of soda as a top dressing on either very poor soils or hard, tight-textured black clays of the open plains type has given increases up to 100 lb. seed cotton per acre, which yielded barely an economic gain. Likewise, on some of the older cultivated scrub soils where the potash content is low, increases up to 80 lb. seed cotton per acre have been obtained from applying 1 cwt. sulphate of potash, but this again was barely an economic gain.

The most disappointing results have been obtained where superphosphate and rock phosphate have been used in an endeavour to counteract the effect of excessive amounts of nitrates in the alluvial loams. To date no gains have been obtained by applying even large amounts of superphosphate or rock phosphate, either in the drills before planting or as top dressings when the plants were at different heights.

PLANTING SEED.

All planting seed is saved from only the higher grades of pure seed plots of each variety. After the seed is obtained at the ginnery it is first heated at 140° F. to kill all insect life, and a portion of the stocks are then delinted to remove sufficient fibres to allow of the seed being used in "walking stick" hand maize planters in the new scrub burns, and also in ordinary planters equipped with maize plates.

It is strongly recommended that delinted seed be used, except where sowing in the dry soil is contemplated. Experiments at the Research Station have demonstrated that with delinted seed a more even distribution is obtained in the ordinary cotton planter, and a lighter rate of seeding can be used—12 lb. of delinted seed giving a germination of 3·7 to 4 plants per row foot, whereas 15 or more lb. of undelinted seed would be required for such a stand. It is recommended, however, that a slightly heavier rate of sowing be used on new cultivations or following fodder crops, for the more open soils will dry out sooner in the upper surface and possibly reduce the amount of germination. A quicker germination is also obtained with delinted seed, as shown in the following data obtained at the Research Station:—

TABLE I.

Seed.	Sixth Day.	Seventh Day.	Eighth Day.	Ninth Day.	Tenth Day.	Eleventh Day.	Twelfth Day.	Plants.
	%	%	%	%	%	%	%	per ft.
Delinted ..	49·1	65·2	69·4	72·4	73·8	75·2	76·3	4·5
Undelinted	7·9	25·7	33·9	40·9	44·9	49·6	52·3	2·0

It is not recommended that delinted seed be sown in dry plantings, for, owing to the ability to absorb moisture better than the undelinted seed, light showers will start germination, and if sufficient rain does not fall the seed will rot, whereas the undelinted seed would be unaffected.

TIME OF PLANTING.

The most suitable time of planting in the cotton districts south of and adjacent to Rockhampton appears to be associated with the soil types. On old cultivations of fertile alluvial loams and clay loams, and on the average of the scrub soils, the best results over a series of seasons have been obtained from plantings made during late September and the first half of October in the Central District, and the latter half of October in the Southern districts. On old cultivations on the heavier clay loam slopes of the forest series plantings up to mid-November can be made with good prospects of obtaining highly profitable yields. Likewise, plantings can be made later on new cultivations on all soil types; several instances of early December planting have been reported as having yielded excellently. No advantage appears to be obtained by planting in August or early in September, even if climatic conditions are favourable, for the low soil temperatures retard germination, and later rains chill the young seedlings so much that usually early October plantings catch up with them, and often have a much better stand. In some seasons a very heavy loss of terminals occurs in the early September plantings through insect attacks, while later plantings suffer much less damage.

METHOD OF PLANTING.

Several methods of planting cotton seed are used in this State, all of which give good results when favourable conditions exist. In most districts, however, it is believed that the best results will be obtained by waiting until good planting rains occur, harrowing to make a nice mulch, and then planting with a split-wheel type of planter equipped with disc openers. The harrowing not only warms the soil and thus hastens germination, but also checks an early growth of grass and weed seedlings, which is of marked advantage in reducing the costs of cultivation. Undoubtedly this is an important point and one which is not receiving sufficient attention by many farmers. The harrowing before planting is particularly necessary when cotton follows Rhodes grass, for if not done then the grass seedlings germinate with the cotton and soon require hand-chipping.

Growers planting large acreages of cotton are faced with the problem of getting their crops sown so that they will obtain the fullest benefit from the spring rains. As these seldom occur in more than 2-inch storms, and often lighter, it is frequently impossible to get planted on the one storm unless considerable equipment is available. Some growers therefore plant all their acreage in the dry soil prior to the spring rains; others plant half in the dry and half following the first good rains, while others plant as much as the soil moisture will allow following the first rain, and then wait for further rains to complete their plantings, The latter system is preferable in some respects, for it distributes the future operations over a longer period and thus eliminates a peak demand for a large amount of labour in any of the larger cotton districts. The spring rainfall is most uncertain, however, and it is advisable to take full advantage of any rains occurring. It is believed, therefore, that the system of planting a portion of the acreage in the dry and the rest after good rains occur is the best. The proportions depend on the equipment available. Usually sufficient rain falls to allow of planting for at least three days under satisfactory germinating conditions. By planting in the dry all but the acreage that can be handled in three days it is possible to obtain a highly satisfactory strike over a large acreage from the one rain. It

is pointed out, however, that the dry planting should be harrowed as quickly as possible after the rain, in order to eliminate weed and grass seedling growth, especially if the germinating rains do not occur until late October or November. The cotton seed will germinate quickly then, and any delay in harrowing may destroy some of the cotton seedlings. It undoubtedly is advisable to harrow the dry planted portion, for each season witnesses growers increasing their cost of cultivation simply through omitting this early harrowing. Dry planting has drawbacks, however, in that in some seasons much loss of seed is experienced through the spring showers being just enough to germinate the seed, after which there are no following storms to establish the seedlings. In wet springs severe crusting of the heavy soils occurs, often in the dry planted areas, even if harrowing is done, and frequently no strike is obtained or one just good enough to influence the growers to leave it, although the stand is not sufficient to allow of the soil producing the maximum possible yield. The problem is a difficult one, and the general district experiences for each soil type are the best indicators of the merits of each method.

Many growers of small acreages in the older agricultural districts, who have maize planters unsuited for planting undelinted cotton seed, have adopted the practice of opening shallow furrows, sowing the seed by hand, and then covering with either a harrow or scuffler. This system undoubtedly causes loss of moisture and undoes the benefit obtained from an early preparation of the seed-bed. It is suggested, now that delinted seed can be obtained, that where an ordinary one or two row maize planter is available, the plates be modified to make them suitable for planting cotton seed. This can be done by enlarging the holes in the six-holed plates and adjusting the gears to allow of the proper rate of seeding.

The provision of delinted seed is of great assistance to the growers in the newly burned scrub areas, for it eliminates the necessity of treating the seed to make it suitable for using in the "walking stick" hand planters. There may be some danger, however, in sowing the delinted seed in the dry ash before the planting rains occur, on account of the delinted seed germinating with less rainfall than would be the case with treated seed; hence in a spring experiencing light showery conditions considerable replanting might be necessary. It is suggested, therefore, that a grower plant only a portion of his scrub acreage in the dry ash until sufficient experience has been obtained to demonstrate the degree of danger associated with such a practice in each of his soil types.

DEPTH OF SOWING.

The correct depth of sowing varies between 1½ and 2½ inches, depending on the condition of the seed-bed, amount of moisture in the surface soil, and the method of planting. The main objective is to get a good stand as quickly as possible. This requires planting the seed just deeply enough to have sufficient moisture to germinate them, and still not have the soil dry out before the young roots penetrate into the moist subsoil. For most soils under average conditions a depth of about 2 inches in moist, firm soil will allow of a good germination being obtained. This is especially true if a split-wheel type of planter is used. Where the seed is covered by scrapers, or by scufflers if planted in shallow furrows, 2½ inches will probably be better, as the soil is not compacted and there is a danger of the moisture being lost before germination is effected, particularly if drying winds are experienced.

If plantings are made at a greater depth than 2½ inches there is always a danger of the seed rotting in a cold wet spring, and in a dry spring, while germinations may be obtained, the seedlings are frequently so long in coming through the surface that they are thin and spindly and of a pale yellowish colour rather than the usual healthy green. Such weakened seedlings are likely to be attacked by diseases if wet weather is experienced subsequently, and may wither if hot, dry winds prevail for any length of time. Generally speaking, the tendency is to plant too deeply, especially in the plantings in September and early October, when the soil temperatures necessitate quick germination and an early appearance of the seedlings above ground.

SPACING OF ROWS.

A spacing of 4½ feet between the rows is generally used in all the cotton-growing areas. Widths varying from 3½ to 5½ feet were used at first, but experiments and the general experience of growers indicate that around 4½ feet appears to be a fairly good row spacing for most soils over a series of seasons. It is possible, however, that where cotton is being grown on the clay loam forest slopes away from the immediate coastal areas, a spacing of 4 feet or 4 feet 3 inches may be suitable. Usually the plants do not grow so tall on such soils as on the alluvials; hence under moderate rainfall, ample sunlight and air movement may be obtained with the closer distances.

It is not recommended that spacings smaller than these be tried, for with heavy rainfall accompanied by prolonged cloudy weather in February there is a grave danger of a growth sufficiently rank being made to create dense shade. Experiences of past seasons have indicated that such conditions are conducive to insect attacks, accompanied by heavy losses from boll rots on the lower portions of the plants.

CULTIVATION.

It is recommended strongly that proper attention should be given to the cultivation of the cotton crops during the early stages of growth. The general tendency is to wait until the plants are 4 to 5 inches tall before the first cultivation is made. In most seasons considerable development of pigweeds and summer grass will be present by then, especially when early showers are experienced, and it will be nearly impossible to destroy all such growth without hand labour, even with the most efficient cultivators. This not only increases the cost of production needlessly; but, where only light rainfall has been experienced, moisture has been robbed from the soil around the plants which should have been conserved by careful mulching and clean cultivation. The practice at the Cotton Research Station is to harrow after the rain before planting and cultivate close to the row as soon as the seedlings are 2 or 3 inches high, using a riding cultivator equipped with tines 2¼ inches wide, and guards to prevent the soil covering the plants. This eradicates all weed and grass seedlings, establishes a nice mulch around the plants, and helps to prevent any further growth of weeds in the row. If rainfall is experienced before thinning time, it will be necessary to cultivate again, especially on old cultivations, otherwise this can be avoided until the thinning is done. A careful cultivation is given after thinning to re-establish the mulch between the rows and around the plants. This should be done as soon as possible on account of the removal of much of the mulch in the row during "chopping" operations, as the thinning with a hoe is termed.

Generally speaking, not more than three or four cultivations should be required after the one immediately following the thinning if cotton is grown in rotation with Rhodes grass; on old cultivations as many as ten may be required. At each of these operations it is recommended that the soil be worked to the plants, for not only does this help to control weed and grass growth but a firm brace is established around the plants which assists in preventing them from being blown over during severe storms when the soil is wet.

The greatest efficiency should be obtained in the cultivation operations. For most districts it is recommended that the best work can be done with the two-row cultivator of the type in which the driver steers with his feet the carriage on which the tines are fastened, rather than depending entirely on being able to guide the horses. There are several makes of this type of machine on the market, all of which can be equipped with tines, sweeps, duck feet, and in some cases discs. By using such a type of machine not only can better work be done close to the plants, thereby avoiding the necessity of much hand hoeing of the crop, but a greater acreage can be cultivated in a day, thus reducing the cost of production in two ways.

Plate 110.

Illustrating efficient cultivation. The plants in the foreground are velvet bean seedlings, which are very brittle, yet with the equipment being used no damage was done to them. The soil is of a clayey nature and the cultivating is being done three days after a heavy downpour.

It is advisable to continue the cultivation as late as possible, for with the beating nature of the usual mid-seasonal storms, a very large amount of the rainfall runs off the compacted soils, especially in the older cultivations. Soil moisture determinations at the Research Station

in 1932-33 demonstrated that following a long dry spell a storm of 2·94 inches—occurring in two falls, one late in the evening and the other early next morning—failed to increase the moisture content of the soil in the 4 to 6-inch level on non-mulched old cultivation. Late cultivation must be maintained to allow of as much penetration of storm rains as is possible to obtain. With a one-row scuffler very tall cotton can be cultivated by using long traces and a spreader close behind the horse, with the ends of the spreader wrapped with hessian to protect the branches of the plants. Little damage is done in tall cotton cultivated in this manner, and the destruction of weed growth and establishment of a mulch in the "middles" is of marked assistance in developing the late middle crop of bolls in an ordinary season. If the last cultivation is made when the surface soil is dry and crusted enough to break up in clods, it will be all the better for retarding the run-off of storms.

HEIGHT OF THINNING.

The question of what is the proper height of plant at which cotton should be thinned is very important under Queensland conditions, for with the light rains that are often experienced in the spring, competition for moisture becomes very acute in unthinned cotton. On the other hand, several different insect pests attack the terminals of the cotton seedlings early in their growth and the growers are loath to thin too early, especially in seasons when cutworms are present in large numbers, for fear of losing their stand of well-formed plants after thinning.

Experiments conducted at the Cotton Research Station, while yielding varying results, indicate that thinning when the plants are 6 to 8 inches tall can be expected to yield better than do later thinnings. Apparently thinning at this height is conducive to the formation of fruiting branches low on the plant, which allows of the early flowering, setting, and maturing of the crop. Indications have also been obtained that there is a tendency to produce more five-locked bolls, thus increasing the average weight of boll per plant.

Many cotton growers are dairying as well, and therefore have but limited time between milkings for field work. It is believed, where a large acreage is being grown and the thinning has to be done without employment of labour, that it is better to start operations when the plants are 4 to 6 inches tall, for this is the easiest height at which to thin, and the chances of completing the thinning before the plants are too tall will be increased. The same suggestion applies where labour is employed by contract thinning in the large areas. Thinning when the plants are from 4 to 8 inches tall enables the men to cover a greater acreage a day, and thus allows of the cost of thinning being kept at an economic level.

METHOD OF THINNING.

Opinion is somewhat divided in Queensland regarding the necessity of thinning. Some growers maintain that a light planting of delinted seed, which the ordinary cotton planter distributes fairly uniformly spaced in either singles or scattered bunches—a 9 to 10 lb. rate of sowing averaging from 2 to 3 seed per row foot—gives satisfactory results. Others sow about 15 lb. of delinted seed and then cross-harrow when the seedlings are 3 to 4 inches tall, which tends to knock out thick bunches and leave a fairly uniformly spaced thin stand. Most of the

growers believe, however, in thinning out to wider distances with the hoe, and where this is done a greater rate of thinning could be accomplished if more attention were paid to the use of the right type of hoe. One frequently sees heavy chipping hoes with clumsy, twisted sapling handles used in thinning or "chopping" cotton. It is difficult to do skilled chopping with such an implement, and it is recommended that a light type of goose-neck garden hoe be used instead. Not only can the strokes be guided more accurately when using the lighter hoe, but they can be made with much less fatigue, which will result in a greater acreage of chopping per day.

The angle of the set of the blade to the handle of a hoe is most important, as a hoe suitable to a tall man is not at all suitable to a short one, for in chopping cotton the art lies in cutting off the plants cleanly at the surface of the ground with the least effort. A blade set at too acute an angle tends to split the stalks rather than cut them off cleanly, while, if set too close to a right angle, it tends to enter the soil too deeply and requires very accurate guiding. The cutting edge should be kept well sharpened with a file, especially on the corners, which play a very important part in skilled chopping. Greater attention to what may appear to be minor points undoubtedly increases the efficiency of cotton chopping.

Experiments have been carried out with a cotton thinning machine of the oscillating chopping blade type, but not very successful results have been accomplished with it. Cultivators equipped with discs have also been tried and have given fair results. Machines similar to low two-wheeled orchard cultivators have been designed in the United States, and reports indicate that up to 20 acres a day can be thinned out in bunches by cross cultivating with them. Where an orchard cultivator with 8-inch duck feet is available, it should be experimented with, for any machine which will thin the plants into bunches spaced to the distance desired reduces the cost of thinning appreciably, as a final stand of one plant per bunch is then cheaply obtained with a hoe.

DISTANCE BETWEEN PLANTS.

The best distance to space the plants when thinning depends, broadly speaking, on the height they are likely eventually to reach. Where the plants generally grow to a height not exceeding 3 feet, they can be left closer together than where they normally grow to 4½ to 6 feet tall. Unfortunately, variable seasonal conditions affect the results obtained at all spacings, so that the best distance to space the plants narrows down to the one giving the greatest factor of safety in each soil type under a wide range of climatic conditions. This varies with varieties—those of more open habit of growth standing closer spacing than the ones with large leaves and coarser vegetative development. Generally speaking, however, 12 to 18 inches can be depended on for the spacings on the soils where the more open plant growth is made, while 18 to 24 inches appear to do better over a series of years where taller growth is generally experienced. Closer spacings on the poorer soils may sometimes produce heavier yields, but there is always a danger of the size of the bolls and quality of the fibre being affected by moisture shortage during dry periods of high temperatures. Undoubtedly a lot of weak and wasty fibre is produced each season through the growers not spacing out their crops sufficiently to enable the plants to withstand adverse conditions.

Another point against spacing too closely is that under excessively wet mid-seasonal conditions rank growth is likely to develop in all varieties on many of the cotton-growing soils of this State. Such growth is accompanied nearly always by excess shade, which is very attractive to various kinds of insects injurious to the cotton crops. Most of these pests either destroy the bolls or puncture them so badly that internal boll rots, which are also increased under conditions of shade and high humidity, attack the crop and cause either entire loss of the boll or serious staining and weakening of the fibres. An open airy surrounding for each plant is highly desirable under Queensland conditions, and the spacing problem is to obtain this to the fullest extent without sacrificing too much row space between the plants. It is recommended, therefore, that the abovementioned distances be used for the general spacing until it can be ascertained if others are more suitable for the particular type of soil being used.

HARVESTING COTTON.

The harvesting of cotton is the most expensive item in the production of this crop, and the way in which the crop is harvested has a decided effect on the quality of the lint produced.

One of the most important points to observe is that cotton should not be picked either when it is wet from exposure to rain, or when it is green, as fibres are called before the bolls have been open long enough to allow the fibres to dry out thoroughly. Not only is it difficult to clean leaf and trash out of cotton in either condition, but during the ginning operations the saws cut the wet fibres very badly, and also tend to leave them in a twisted, ropy state. Lint of this nature is easily detected, and the buyers penalise it heavily, for much waste is obtained from such cotton during the spinning operations. Picking may be done while the dew is still present, but the cotton should be spread out in the sun to dry during the forenoon, after which it can be baled with the rest of the picking of the day. It is not necessary to dry the cotton which is picked after the dew is off, providing "green" cotton is not included.

PRESERVING THE "BLOOM" OF THE CROP.

Another important point when harvesting cotton is to guard against leaving the cotton exposed too long to the weather. Cotton, when the bolls first open, has a nice richness of colour, or "bloom" as it is termed, and it is necessary for a sample of cotton to have this "bloom" before it can be graded into the higher grades of the regular universal standards, although it may be free of trash. When cotton is left unpicked for several weeks the bloom is lost through the bleaching action brought about by the nightly wetting with the dews and the subsequent drying by the sun. This changes the colour to a chalky dead-white and also destroys the lustre of the fibres. The effect of storms on cotton is worse than the dews—the colour is changed to a dull greyish tinge, and even to a light bluish tinge when rains lasting several days are experienced. When rains do occur cotton should not be picked until several days of sunshine have been experienced, in order that the dews and sun may bleach out the stains, and the wind and heat fluff out the fibres from the matted condition caused by the rain. This greatly improves the appearance of the lint, and raises both the lint and seed cotton at least a half-grade. A benefit is thus

obtained in two ways by delaying picking after a storm until the cotton has improved in appearance—the cotton is of greater value, and no payment is made for picking moisture.

EFFECT OF HIGH WINDS.

The picking of cotton also should not be delayed too long on account of the effect of strong winds. With the continuous movement of the plants in windy weather the locks tend to hang out of the bolls in a long, stringy condition. This not only allows the cotton to dry out excessively, thus losing weight and adversely affecting the character of the fibres, but also makes the seed cotton difficult to gin properly, owing to a considerable proportion of the locks being in a twisted, rope-like condition which gathers up bits of broken bracts and leaves in windy weather, especially if severe frosts have occurred. It is difficult to clean such trash in the ginneries, for the smaller pieces are generally twisted in amongst the fibres. In addition to these disadvantages, much greater loss of crop on to the ground occurs in wind-blown cotton during heavy storms than where picking is done at proper intervals. It can be appreciated, therefore, that cotton should not be left unpicked too long. Where the harvesting is done by the grower and his family it will pay to make several pickings in a good crop, depending on the season. Where labour is employed it has to be remembered that sufficient bolls must be open to allow the picker to make a reasonable tally, otherwise the cost of picking necessarily will be higher. Generally speaking, it has been found satisfactory when employing labour to make one good picking and then a clean-up in fields of light to medium yield, and two pickings and a clean-up in good crops.

HOW TO PICK.

Picking can be done best by using both hands working independently of each other, but guided by eye each time. This enables one to fill both hands before emptying into the sack and saves an amazing number of movements during the day. Generally a sack is strapped around the waist so that the weight of the cotton is on the ground and the mouth of the sack hangs open, thus enabling the cotton to be put in quickly. With the modern cleaning machinery installed at the ginneries it is not necessary to pick only clean cotton, for a certain amount of the bracts, the leaf-like parts surrounding the boll, may be included, provided they are not in twisted cotton, as they are removed in the cleaning machinery before the cotton is ginned. The amount of stained cotton should be kept to the lowest minimum, however, for the stained fibres are much softer and weaker and are cut up in the ginning, while their colour lowers the value of the rest of the lint. The hard, diseased locks should not be included, for these are so much waste for which the grower pays picking charges, and the Cotton Pool pays freight—the grower thereby losing in two ways. Cotton containing these hard locks has to be graded low, for a certain amount of the softer diseased ones are ginned with the good cotton, thereby lowering the value and thus making a third loss to the grower.

The most difficult matter to remove from the cotton lint is grass and weed seed, especially spear grass seed, and every effort should be made to clean the fields at the last cultivation so that no seed will be produced. On old cultivations, even where good farming practices have

been followed, there is always danger of tall-growing weeds in the rows setting seed late in the season, and it pays to chop out such weeds before the harvesting commences, especially if pickers are employed.

SNAPPING.

Cleaning machinery is installed at the Glenmore and Whinstanes ginneries for treating snapped cotton. Snapped cotton is obtained by snapping or jerking the whole burr and contents from the plant, and should be practised only after heavy frosts have been experienced. Snapping unfrosted bolls tears the plant badly, and the cotton when packed in containers for forwarding to the ginnery "sweats" so that it is difficult to clean and gin. In addition to this, freight is paid for the green sappy burrs, leaves, and portions of the plant instead of light, dead material. Snapping undoubtedly lowers the grade of most of the mature cotton of high quality to the point where the full value of the lint cannot be obtained. On the other hand, snapping the top crop of bolls, which usually contain cotton of lower quality, not only does not lessen the value materially, but enables a considerable amount of cotton to be harvested cheaply which would often not be picked in the ordinary manner. Only bolls containing marketable cotton should be snapped, however, for the dry, hard diseased bolls, or "hickory nuts," as they have been termed, contain no cotton, and are removed in the cleaning machinery before the seed cotton is weighed, while the weak and wasty fibres of partially developed bolls are so badly gin-cut as to lower the quality of the whole bale. Under no circumstances should wet or even damp-snapped cotton be forwarded to the ginnery, for only lint of the lowest grades can be obtained from it, as the big pieces of moist bracts become so entangled in the fibre that the cleaning machinery cannot remove them. Snapping is of value to Queensland cotton growers, but should be used properly.

PACKING COTTON.

Owing to the distance of the cotton fields from the ginneries in Queensland the crop is forwarded by train either in bags or wool packs containing around 80 to 100 lb. and 500 lb. of seed cotton, respectively. The growers of small acreages generally use second-hand chaff-bags, &c., while those with more than 5 or 6 acres usually purchase once-used wool packs for their crop. It is cheaper to use the wool packs, for grower's individual ones are returned for a small fee which covers cost of freight and heating to kill the pink boll worm or any cotton pests in them, whereas the bags are not, and thus represent a loss to the grower.

CLEAN CONTAINERS NECESSARY.

Before filling a container it should be cleaned carefully to remove everything that might affect the grade of the cotton, and wool packs which have had cotton in them should be cleaned especially in order to protect the purity of seed. Growers should pay particular attention to this feature, for undoubtedly much contamination of pure seed varieties can be brought about by admixture caused through bits of seed cotton sticking in the corners of bales and being attached to strands of the sewings along the edges.

UNIFORMITY OF GRADE IN EVERY BALE.

When packing a container every care should be taken to have only the one grade and staple of cotton in it. A bale of lint is sold

on the basis that it contains cotton of uniform grade and staple length. If there is any variation of content encountered it is purchased on the basis of the lowest grade and shortest staple contained. It is most important, therefore, that growers should pay careful attention to forwarding containers with uniform contents, and it is strongly recommended that some effort be made to grade the cotton before putting it into bags. Usually two, and in some fields, three grades should be ample, for with the exception of droughty spots or places of rank growth, the quality of the crop over a field, if picked in a short time, is more or less the same. By having a bale each for good grade; leafy cotton; and cotton which is insect stained or from droughty parts in the field, a grower, especially with a large acreage, would not only obtain the full value of his crop, but would be forwarding containers of uniform contents, thereby assisting the industry generally.

Plate 111.

Packing Cotton.—A baling centre in the field. A once-used wool pack is suspended by plain fencing wire and the cotton tramped in until approximately 500 lb. weight is obtained.

FORWARDING COTTON.

Every grower has a registered number, and should include this with his initials and railway station in a brand for identifying each container he sends. The brand should be placed in a conspicuous place on the side of the container in black that will not rub or wash off. Each season a number of wool packs are received at the ginnery which have no identification marks, or on which the brands are so indistinct that they are not legible, and it is only through checking up the advice notes which a grower despatches to the Cotton Board when forwarding his cotton that the ownership can be established. This slows up the work at the ginnery, and should not occur.

GRADING.

When the container of seed cotton arrives at the ginnery the contents are examined by a grader, who first determines the grade. "Grade" means a combination of the colour, body, and strength of the cotton and the amount of trash or foreign matter in it. The grades used are based on the Universal Standards for American cotton, which are recognised in all official cotton exchanges. The grader determines next the length of the fibres, or staples it, as the operation is termed. Each container is then weighed and checked against the amount of cotton the grower states on his advice note to the ginnery, after which it is segregated into the proper stack for ginning according to the grade and staple. When the cotton is being ginned two samples are drawn from each bale of lint in such a way as to represent the true contents. These are sent to the classing room, where another grader staples and grades them against a set of lint standards, which are based on the key set of Universal Standards for American cotton that is obtained from the United States Department of Agriculture, every time new reference sets are prescribed. The true contents of each bale of lint are thus determined before delivery to the spinners. The lint grader is also advised of the grade and staple of each container of seed cotton from which each bale of lint is obtained. This enables him to check on the classifications of the seed cotton grader throughout the season and thus ascertain if the seed cotton is producing lint of the quality that has been estimated before it is ginned.

GINNING.

The product obtained from the open boll is composed of seed and fibres, and is called seed cotton. It is necessary, therefore, to separate the seed from the fibres before the latter can be spun into yarns of various kinds, and the process used in effecting the separation is called ginning. The basic principle of all ginning establishments or ginneries, as they are termed, is first to remove as much trash, dust, and other foreign substances as possible by various cleaning machines, and then to separate the fibres from the seed. There are two kinds of ginning machines—roller and saw. The roller gin consists of either one or two long leather covered rollers which revolve at slow speed and pull the fibres between a fixed knife pressing on one roller, and a stripper bar which tends to push the seed out of the fibres as they are drawn through by the rollers. This form of ginning is used mostly for the very fine diametered long staple Sea Island, Egyptian, and similar types of cotton, as owing to the slow ginning the long fibres can be removed from the seed without damaging them. The American Upland cottons and similar types are ginned on saw gins which have a much greater output for a given time and therefore greatly reduce the cost of ginning. The saws of this type of gin closely resemble the ordinary circular wood saw, only the teeth are of finer width and mounted at an angle which points them in the direction in which they revolve. The saws are usually 10 or 12 inches in diameter and 70 or 80 of them are mounted approximately five-eighths of an inch apart on the one spindle. A steel half-circular grid slotted to match the spacing of the saws is mounted so that the teeth of the saws just show through on the concave side of it. This grid is part of a cylinder into which the cotton drops after being cleaned, and as the saws revolve and remove the fibres from the seed a rolling

motion is imparted to the seed cotton which forms it into a big core of seed and seed cotton. This is called the breast roll and is of marked assistance in the ginning, for as the locks of seed cotton are fed into the cylinder, the breast roll presses them against the saws, which insures uniform removal of the fibres from the seed. An air-blast blows the fibres from the saw teeth into a condenser, whence they are fed to hydraulic presses for baling. The resultant bales are enclosed with a hessian covering and then bound with heavy wire ties, the average bale weighing 500 lb.

OIL MILL OPERATIONS.

The cotton seed separated from the fibres are important to the cotton industry, in that they are the source of several valuable by-products which are obtained in the oil mill. When the seed arrives at the oil mill it is covered with dense short fibres called "linters." These have nearly as many varied uses as have the long fibres or lint removed in the ginning operations. Among the more important, are their use in making motor-car upholstery, felts, medicated cotton, and after being treated chemically, as a source of supply of cellulose for the manufacture of high explosives and artificial silk. Large quantities are used annually throughout the world. All foreign matter is first extracted from the seed, and the linters are then removed by delinting machines which resemble the ordinary gins used to remove the cotton fibres. The delinted seed are next hulled to remove the seed coats, after which the kernels are rolled or "flaked" and cooked to release the oils. The cooked meal is then spread in a thick layer between cloths made of camel hair and pressed in hydraulic presses to extract the oil. The residue is in the form of a hard slab called "cake." After the cloths are taken off, this is ground into fine golden coloured meal, which is a valuable concentrated stock food of high protein content that is used in large quantities in dairying countries where "hand feeding" is practised. Unfortunately, the value of cotton seed meal has not been sufficiently realised by Australian dairymen, and a large proportion of the meal has been exported as "cake" during good seasons in past years. In the 1936-37 drought, however, the supply of meal could not meet the demand, and it is to be hoped that in the future a greater regular use of this meal will be made by dairymen. Cotton seed meal is also a valuable sheep feed, and for this purpose it is pressed into cubes so that the sheep can be fed in the paddocks without loss of meal. A quarter of a lb. of cubes a day with some roughage keeps the sheep in good condition, and such feeding has been the means of saving thousands of sheep during very dry years. Cotton seed meal is also a valuable food for pigs, calves, and horses when fed in proper amounts. Information should be obtained from the Department of Agriculture and Stock for the correct feeding of these animals.

When the cooked kernels are pressed, a fatty oil is obtained which, after it is refined, is used in the manufacture of margarine, toilet soaps, and for cooking oils. Practically all of the Australian requirements for cotton seed oil are supplied by the Queensland Cotton Board.

From even this brief outline of the oil mill operations it can be realised how valuable are the cotton seed and their by-products, and what an important part they have in the economic life of a community. It is mentioned in this respect that approximately 7,000,000 tons of cotton

seed are crushed annually throughout the world. It is especially important to a pastoral country like Australia that large supplies of cotton seed meal be produced locally, and it is to be hoped that a greatly increased use of such a suitable concentrated stock food will be practised when its value is more fully realised.

MARKETING.

The whole of the Queensland cotton crop is handled each season through a compulsory Cotton Pool, which is managed by a Cotton Board composed of one elected cotton grower from each of the six districts into which the cotton areas are divided, and a representative of the Director of Marketing of the State Department of Agriculture and Stock. As soon as a grower places his cotton on rail the Pool takes possession and pays all transportation, ginning, and marketing costs. The growers, through a Co-operative Association, own their ginneries for ginning the crop and the oil mill for treating the resultant seed, thus ensuring to them the full value of their crop.

When a consignment of cotton arrives at the ginnery it is graded and the poundage of each grade and staple length is obtained, for which a first advance is paid to the grower, which usually is an estimate of 80 per cent. of what the average basic value of the crop will be, plus a premium for the grade and staple if his cotton is above the basic value, and any bounty paid by the Commonwealth Government. As sufficient moneys accumulate from the sale of the crop, further advances on a flat rate per pound of cotton are paid to each grower until the sale of the crop is completed.

The sale of the crop in Australia is made direct to the spinners by the Cotton Board, so that no commissions are paid other than those to overseas brokers selling any portion of the crop not required in Australia. Under this system the grower is assured of his crop being ginned and marketed to the best advantage for him. Charges are eliminated wherever possible, and the costs of operation more than bear comparison with those of other countries working with labour charges similar to those of this country.

YIELDS.

Cotton, in common with all other crops that can be grown in the cotton-growing districts, is subject to fluctuations in yields caused by various factors. Adverse climatic conditions, unsuitable soils, incorrect cultural methods, wrong varieties and insect attacks, all affect the yield obtained from a crop of cotton. Generally speaking, however, where the right combination of variety, soil, cultural methods and climatic conditions exist, good to excellent yields are obtained over much of the south-eastern portion of the State. As the growers become more experienced and further progress is made in solving the problems connected with soil investigations, developing improved stocks of the best varieties and combating insects, which in some seasons cause serious damage in some districts, the general average yield will undoubtedly be raised. As it is, the average of the better growers over a series of years is 700 lb. of seed cotton per acre or higher, according to climatic and soil conditions. In good seasons yields of 1,200 to 1,500 and occasionally 2,000 lb. seed cotton per acre are obtained by the best of the growers in many of the districts. The

problem confronting all concerned in the industry is to ascertain and adopt methods which will produce yields each season in keeping with those now obtained by the better growers. Undoubtedly much progress can be made in this respect if all growers pay greater attention to the points which have been touched upon, for the suggestions offered are based on the methods used in producing the higher yields, and on the results which have been obtained from investigations carried out at the Cotton Research Station and in the different cotton districts.

It has to be realised, however, that failures occur in every agricultural crop that is dependent on rainfall. Although the cotton crop may fail when exceptionally adverse conditions are experienced, the general results that have been obtained indicate that cotton is about the most reliable crop that can be grown in many of the districts which are suited to its production.

COTTON VARIETIES.

The varieties of cotton grown in Queensland are all of the Gossypium hirsutum type, the botanical family which includes the American Upland cottons. During the American Civil War the long stapled Sea Island cotton was grown along the Brisbane, Albert, and Logan Rivers with some success, and following the World War, Egyptian varieties were tried, but without satisfactory results. The Sea Island classes are luxury cottons to-day, and it is only in countries with highly suitable climatic and economic conditions that they can be grown, and even there restriction of acreage is practised in order to obtain profitable prices. The Egyptian cottons likewise require special economic conditions, and do best under irrigation in arid climates.

It is believed, therefore, that the American Upland cottons are by far the most suitable for Queensland. The climatic and soil conditions in most of the cotton districts here are similar to those ruling in many parts of the cotton-growing areas of the United States, where the bulk of the American Upland types are grown. Likewise, these cottons with their larger bolls and coarser fibre can be picked and ginned much cheaper than the small boll, fine diametered fibre types, which is an important point, for the cost of production is one of the main problems connected with growing cotton in this country.

The most suitable variety of cotton to grow depends so much on soil type and climatic conditions that it is suggested the reader had best enquire of the nearest Cotton Officer, Department of Agriculture and Stock, for the particulars concerning his individual conditions unless he is in a one-variety district. A full description of the soil type, original timber, and cropping history should be forwarded, for rather pronounced differences in suitability of varieties exist in many districts.

PURE SEED SUPPLIES.

The responsibility of developing supplies of seed of suitable varieties of cotton for the different districts of the State is vested in the Department of Agriculture and Stock through legislation, passed with the approval of the representatives of the growers at the end of the period of Government guaranteed prices in 1926. A Departmental staff had been organised to develop suitable varieties during the period covered by the guaranteed prices, and it was believed at

the termination of the period that it was desirable the Department should continue to have sole control of the pure seed operations. The aim of the Department has been to organise the districts on the basis of one-variety communities, wherever possible, producing cotton of the highest quality that the conditions would allow. Under this scheme several varieties producing fibre ranging from $1\frac{1}{16}$ to $1\frac{1}{8}$ inches full were developed to supply suitable cotton for export, and then later, as the knitting industry developed in Australia, modifications were made to meet the local requirements. In recent years a demand for cottons ranging from $\frac{7}{8}$ to $1\frac{1}{8}$ inches has arisen, and stocks of seed of several varieties of this type are now available for general distribution. Unfortunately, varieties of this class have shown a marked preference for definite soil types and climatic conditions, and growers should obtain information from the Department concerning them. A large number of varietal tests have been conducted by the Field Staff of the Cotton Section to ascertain the requirements of each variety, and it is possible to supply a grower with a reliable cotton that produces lint of the type demanded by the Australian spinners.

Cotton is an easily cross-pollinated plant, hence it is essential that rigid precautions be taken to reduce all chances of contamination between varieties. It is necessary, therefore, to isolate fields producing seed for planting purposes by at least a half a mile from other cotton and on soil where cotton was not grown in the previous season. Likewise, the greatest care has to be taken at the ginnery to prevent an admixture of seed in any of the operations connected with stacking the containers of seed cotton, ginning, heating the seed to kill insect life, and delinting the planting seed. It is obviously advisable, therefore, to have only the minimum number of varieties necessary to meet all requirements, and wherever possible, to develop a district on the one-variety basis. This is being attempted in all cotton-growing countries, for it has been demonstrated that it is not only advantageous in maintaining the purity of a variety, but also in developing cultural practices, and in marketing the crop.

Unfortunately, any variety of cotton will deteriorate rather rapidly unless the purity of the type is maintained by carefully conducted breeding operations. It is necessary, therefore, to develop a system of seed replacement in every variety grown, whereby in each season pure stocks can be made available for distribution. The system which has been developed in Queensland aims at sending to the oil mill each season all seed that is in more than the fourth year of multiplication after being released for general distribution. By this method it is hoped to maintain a high standard of quality in each variety.

VARIETAL TESTING.

Before a newly introduced variety or a strain of an old established variety can be released for general distribution it is necessary to test it against the varieties already grown commercially to ascertain its merits. Many growers think this can be done by planting single plots of from 1 to 5 acres of the new variety and comparing the yield with that of their general crop. The experiences of all countries have demonstrated, however, that carefully conducted tests over a series of seasons, and on different types of soil, are necessary before the merits of a variety can be fully determined. A field staff has therefore been developed in the cotton section of the Department of

Agriculture and Stock, to assist growers wherever possible, in conducting varietal and strain tests in the main cotton-growing districts. Plans of properly laid out experiments are also sent to growers in the smaller isolated districts, to enable them to test varieties in a manner which will give them reliable results. Each season a considerable number of such tests are arranged, and the results obtained have been the means of determining the most suitable varieties for a large number of individual growers, and for several of the main districts.

Plate 112.

TESTING FOR STRENGTH AND DROUGHT RESISTANCE IN A BIG BOLL VARIETY.—Each season thousands of plants are examined by the cotton section of the Department of Agriculture and Stock, and upwards of 2,000 plants are picked individually for further inspection in the laboratory. Progeny rows of the plants selected finally as worthy of further study are planted in the following season in breeding blocks, where the uniformity of plant and fibre characters is carefully studied. The most promising progenies are kept for further increase and trial. In this manner suitable strains are being developed of the main varieties now being grown.

RESEARCH AND ADVISORY ACTIVITIES.

A member of the Field Staff is stationed in each of the largest cotton-growing districts, to conduct varietal tests, allot pure seed increase plots, carry out cultural and fertilizer investigations, and advise growers on general cotton matters. Another important duty of the field staff is to test out the findings obtained in the investigations carried out at the Cotton Research Station and to develop modifications of them to suit the range of conditions existing in each district.

The work conducted at the Cotton Station, which is in the Callide Valley, the largest cotton-growing district, includes a wide range of studies embracing varietal testing and breeding of cotton, and other crops used in crop rotations; cultural practices, and their effect on the composition of the soils; soil moisture studies; and entomological problems. Wherever possible, problems arising in the cotton districts

are studied at the station, and marked assistance has been obtained from the work carried out there in explaining the causes of some of the difficulties that have been experienced in many of the cotton areas.

CONCLUSION.

This article has been prepared to convey a general idea of the cotton-growing industry in Queensland, and to present suggestions bearing on the most important features to be studied in the growing of this crop. These suggestions are based on the voluminous amount of data and observations that have been collected from the results obtained at the Cotton Research Station, Biloela, and from the investigations conducted by the Field Staff and the Graders. Further details regarding the major aspects can be obtained from the Cotton Section of the Department of Agriculture and Stock, Brisbane, or from the nearest Cotton Field Officer stationed at Rockhampton, Biloela, Monto, Mundubbera, and Kingaroy.

AN EMERGENCY CROWBAR.

A very efficient crowbar can be made from an old double-ended pick head, a large-size gate hinge, and a stout handle of spotted gum or similar wood. The

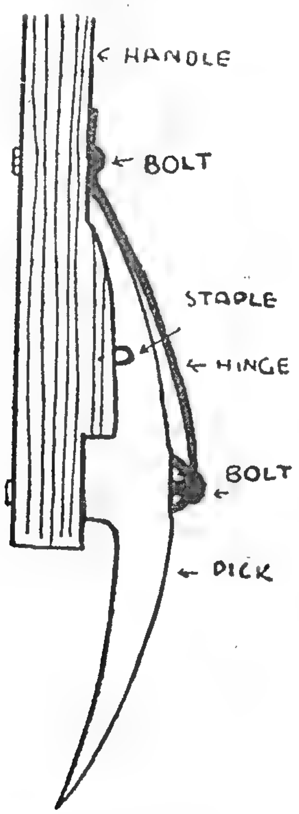
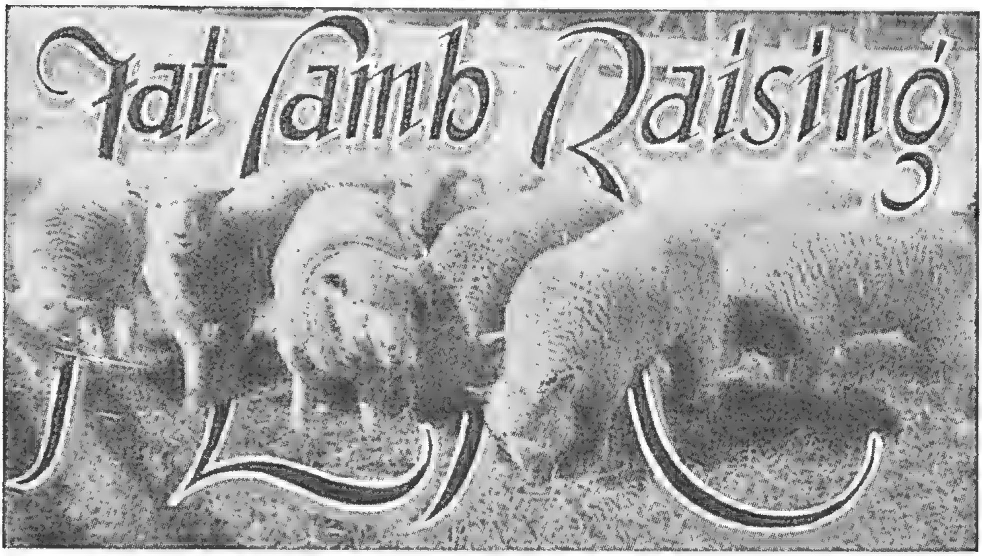


Plate 113.

diagram shows how these are utilised and held together by two stout bolts. This tool will be found most useful when sinking post holes.



Spraying and Jetting of Sheep.

JAMES CAREW, Senior Instructor in Sheep and Wool.

THAT south-western Queensland is capable of producing high-quality merino sheep was made evident by the fact that, during my recent tour of this area, I noticed a big improvement in the young sheep. This may be due to some extent to the good season; but, apart from this, quality and character were showing up very prominently.

At Yamburgan some good-quality young rams were seen. This property has been improved considerably during the last few years and what was, a few years ago, thickly timbered and practically waste lands has developed, as a result of ringbarking, into well-grassed areas capable of maintaining five sheep where previously one could not live. At Noondoo also the flocks now are showing more size and stronger constitutions, and assuredly this will increase the wool yield per head. Needless to say, much forethought and good management is necessary, and this must be backed up with new blood of improved quality and selected to suit the flock.

Difficulties are met with, and these can be surmounted only by grim determination and a knowledge of the most satisfactory methods to adopt. When good seasons come they bring with them a big relief so far as the pastures are concerned; and these were manifest in the large areas of Mitchell grasses which, although dry, resembled waving wheatfields. These good seasons also bring a heap of troubles to the sheep owner in the form of the dreaded blowfly. Where large numbers of sheep are to be protected, this is no mean task and needs to be undertaken in anticipation.

Under the Spray.

Mr. Young, the general manager, was leaving little to chance on the day we arrived at the yards. A large flock of ewes, shorn two months previously, were being put through under the spray which takes the place of a plunge dip to control lice in sheep, and which, owing to its arsenical content, also assists in controlling fly strike.

In the application of this method, the sheep are enclosed within galvanised walls about 8 feet in height, the structure being 50 feet in length and 9 feet 6 inches in width. The bottom is composed of battens which are made in sections to fit from wall to wall, and four feet wide, the battens being placed ½ inch apart to allow for a speedy getaway of the surplus spray. Under this battened floor are 10-feet lengths of corrugated galvanised iron which have a fall to the side where a deep guttering is placed just outside the wall. The 10-feet length allows for the iron to project outside the wall at the low side. There are two galvanised iron gates—one at the entrance and another 25 feet away or in the middle of the enclosure.

The spray fittings are fixed to 1-inch water piping and placed in two rows overhead on cross bars. The mixture is measured into a tank to which a power pump plant is attached, and is pumped into the spray system, which sprays over the sheep for eight minutes. The closer the sheep are packed the better, as the mixture is forced into the skin which it follows, giving a fairly thorough soaking. When completed the iron gate in the middle of the enclosure is opened and the sheep allowed to go forward into the other half of the enclosure. While they are going forward the iron gate leading to the yards is opened, when the sheep to be sprayed will follow readily those which already have been sprayed. The centre gate is then closed and the spray section of the enclosure filled. While these are being sprayed the sprayed sheep are draining and the drip caught by the iron under the floor is drained into the guttering and back through a strainer into a receptacle from which it is used again. Ewes heavy in lamb can be treated by this method without risk, and it is estimated that 8,000 sheep per day can be dealt with.

In another yard sheep with longer wool were held for jetting as a protection against fly strike. In this case the sheep were run through a race in which a cage was placed. This cage is fitted into a frame to allow it to swing or partly revolve, securing the sheep in the cage with its hindquarters fully exposed to allow a thorough jetting.

There is a big difference between spraying and jetting, as the former is sprayed on in a fine shower, while jetting is forced through a nozzle at high pressure—say, from 60 lb. per square inch for short-wooled up to 160 lb. or even over for long-wooled sheep. Care and judgment is necessary, the skin being easily damaged with this high pressure. The recognised strength of an arsenical dipping or spraying mixture is ·2 per cent. arsenic, while for jetting it varies from ·2 to ·8 per cent. in keeping with the regulations.

A PROFITABLE LITTER.

The litter of twelve large white pigs, bred by Mr. M. G. Bayliss, Kinton Stud, Maleny, and check-weighed by the Department of Agriculture and Stock, made a very creditable weight.

Farrowed on 22nd May, 1937, the pigs were from Highfields Pear 29th and sired by Highfields Hardshot 3rd.

The total litter weight at eight weeks old was 446 lb., the average being 37·1 lb.

Type Classification of Pigs.

This article has been abridged from a pamphlet—" British Pigs for Queensland Farms "—issued by authority of the Hon. Frank W. Bulcock, Minister for Agriculture and Stock.

THE farmer desiring to embark in the pig raising industry must give careful consideration to the question of breed characteristics and trade types before coming to a definite decision.

Pigs are usually classed into two trade types, namely, porkers and baconers, and even breeding stock are distinguished as being of the porker or baconer type according to their size and rate of maturity, the smaller and more compact pig being classed as a porker type and the larger and more rangy pig as a baconer type. There, of course, is an intermingling of these two types, and when an extreme bacon type is mated with the extreme pork type the resultant progeny usually are intermediate in type.

With this knowledge we can say that, in general, the Berkshire and Middle White breeds are of the porker type because of their compact structure and their tendency to fatten and provide a "finished" carcase at porker weights, namely, from 60 to 100 lb. dressed. It must be realised, however, that this is merely a general classification of these breeds as a whole and not of every individual animal within the breeds, for a big variation will be found in the types of individuals. Thus, some pigs of the Berkshire and Middle White breeds could be classed as bacon types.

BERKSHIRES IN AUSTRALIA.

England is the home of Berkshire pigs, and from the herds of Great Britain Berkshires are sent to many parts of the world to form new studs and to strengthen studs already established. In Australia the Berkshire is the most prominent among our several breeds of pigs, being found to adapt itself to a wide range of climatic and economic conditions.

The greatest use of the Berkshire pig is made where the breeder wishes to supply a porker market, and breeds Berkshires pure or crossed

with other porker type pigs, or where it is desired to produce a medium type pig such as a heavy porker or light baconer from 100 lb. to 120 lb. dressed weight by crossing typical Berkshires with pigs of the extreme bacon type.

There are some very lengthy Berkshires which, if bred pure and carefully fed, will produce a good light bacon carcase. These pigs are the extreme rather than the average of the breed, but it is important for breeders to realise that such types do occur within the breed.

Breed Characteristics.

The typical British Berkshire is a blocky and symmetrical pig, well covered with flesh, and standing on comparatively short legs, showing reasonably fine bone. The head and face of a good Berkshire should be neither too small nor too large in proportion to the size of the pig, the nose being moderately short and the face slightly dished. The jowl should be light and neat.

Plate 114.

Burnham Prim Boy, sire of the imported boar, Burnham Griqua Baron, whose pedigree is shown herein.

The neck should be of medium length and not too thick, running smoothly into the shoulders, which should be broad enough and deep enough to provide good chest room, but they should not be excessively developed on the sides or top, the shoulders and fore parts of the pig being of low relative value to the butcher and consumer.

The back should be long and slightly arched to give strength. The ribs should spring from the spine, giving a flat back—but not too wide. The sides should then be flat and deep, carrying down straight to give a strong, thick "streak" in the carcase. The loin should be well developed and the hams should be broad, deep, and well-filled in between.

The legs should be relatively short, with fairly fine bone; and they should be placed well apart "at the corners of the body." Legs which are bent or which are placed in underneath the body are undesirable. The feet should be compact and strong.

Both boars and sows used for breeding purposes should have a good number of well-placed and well-developed teats. Twelve or more are usually considered a satisfactory number. As a boar will affect the teat number of his progeny, it is important that he, too, should be well teated.

In general appearance Berkshires should show character, masculinity in the boar and femininity in the sow, quality combined with size and vigour. They should be well-balanced and free from deformities of any kind.

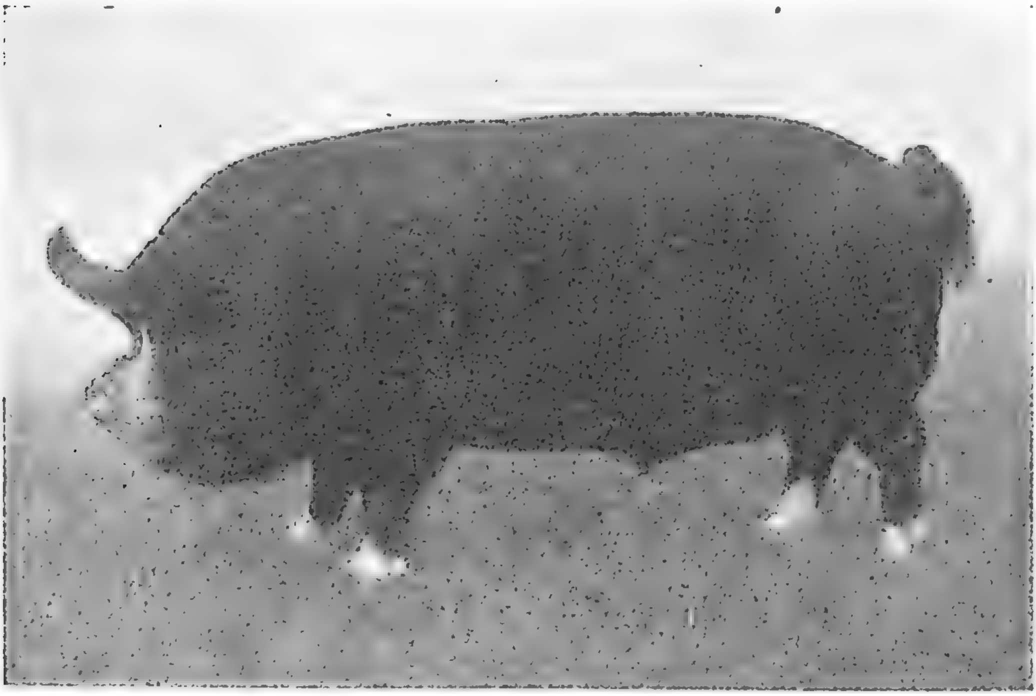


Plate 115.

Dringhouses Resolute, sire of the imported sow, Chapel Rosary, whose pedigree is shown herein.

Early Berkshire breeders fixed as their standard colour of the breed black with white points, i.e., white on the four feet, the face, and the brush of the tail, and this is the standard colour as set down by the breed societies for the present-day Berkshires.

It is well known to those who have had the handling of Berkshire pigs that the standard of colour and markings as set down for the breed is rarely attained, and it is a very difficult matter for breeders to get the exact marking which they require in the breed. Even when well-marked pigs are bred from, the progeny usually show some variation from the ideal marking seen in the parent stock; but it must be understood that there is more chance of getting well-marked pigs by mating boars and sows which are well marked than by mating those which are badly marked. While the breeder of Berkshires wishes to pay attention

to the breeding of well-marked animals, he must not neglect other characteristics such as conformation, quality, and productiveness, which, after all, are the most important features of any breed of pig. It should be borne in mind that pigs are used primarily to produce pork, and it is often necessary for both the stud breeder and the show judge to overlook slight faults in the markings of the animals. So far as it concerns the farmer who is using Berkshire pigs for the production of pork and bacon, the colour markings count little, and the more important characteristics are productiveness, type and quality.

THE MIDDLE WHITE PIG.

The Middle White, also sometimes referred to as the Middle Yorkshire, was founded in Yorkshire, England, by the judicious selection and mating of native and introduced stock, the objective being to evolve a medium type of pig for the production of quick-maturing porkers.

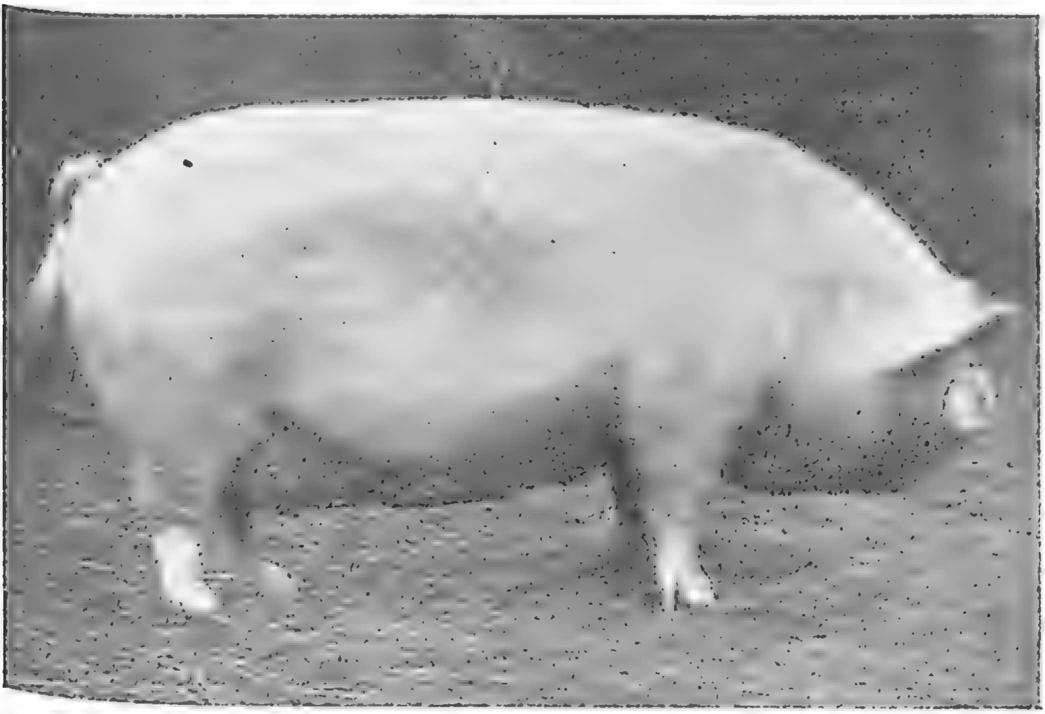


Plate 116.

Fulford Wink, dam of the Middle White boar, Lancefield Gentleman, who was mated to the imported sow, Wratting Patty 3rd, prior to her leaving England.

The Middle White is more compact than the Large White—in fact it closely resembles the Berkshire in general type, but typical pigs of the breed usually have a shorter and more turned-up nose than average Berkshires.

The Middle White pig is used particularly in the production of light-weight porkers or for crossing with larger-type pigs for the production of heavy porkers or light baconers.

The breed has a well-earned reputation in the porker class at Australian shows, and Queensland breeders are familiar with its successes in these classes at Brisbane shows. Middle Whites made a very successful

display in the porker carcase competition conducted at the Brisbane Abattoir some years ago, when pigs of this breed won first and second prizes.

The fine bone and fine white skin of the Middle White porker make it a very attractive carcase which the butcher is always pleased to handle. In addition to its carcase qualities the Middle White is a good farmer's pig, being extremely docile, and the sows are usually excellent mothers and very prolific.

When Middle Whites are mated with Tamworth or Berkshire pigs the white colour is dominant, and the resultant progeny are mostly white.

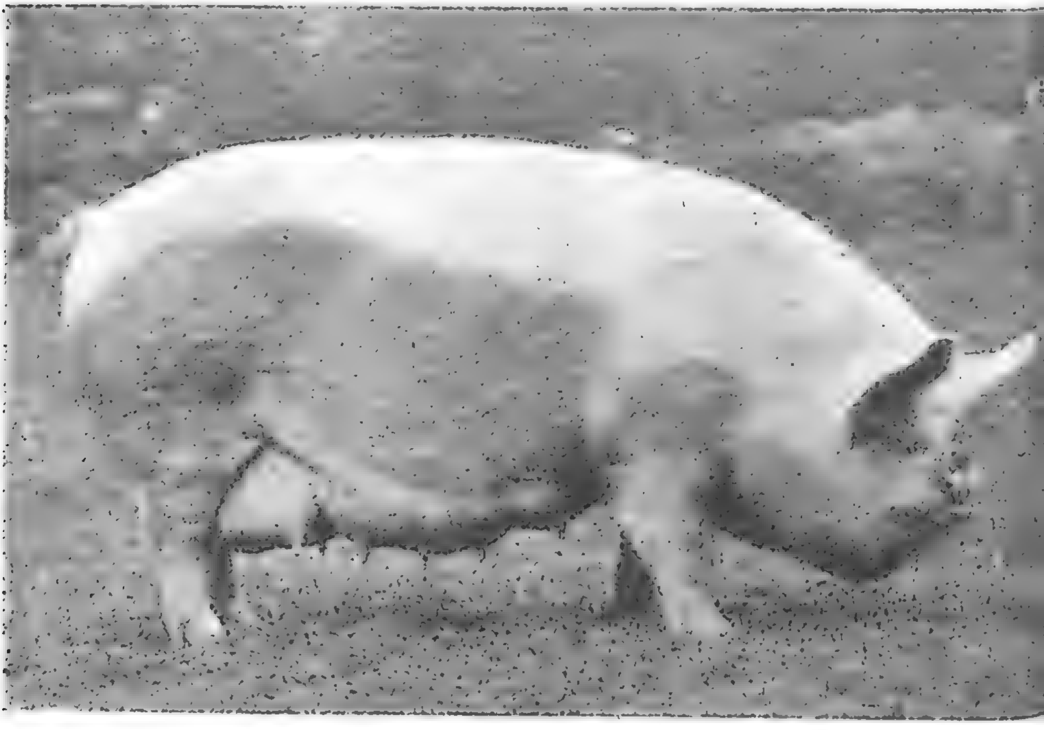


Plate 117.

Watford Gracious Lady, dam of the imported sow, Watford Gracious Lady 37th, whose pedigree appears in this booklet.

Breed Characteristics.

The colour of Middle Whites should be:—Pinkish skin, free from black or blue spots, and a coat of white hair free from black hairs. The nose should be somewhat shorter than that of the Berkshire, but the head and jowl should be light in proportion to the body. The shoulders and neck should be neat and light, the back slightly arched and long. The ribs should spring out to give a flat back, but should then descend to give a straight, deep side and full underline.

The hams of the Middle White should be large in all directions. The legs should be comparatively short, strong, and straight, being set on the outside of the body, not close together or sloping in under the pig. The feet should be compact and strong. At least twelve well-developed and well-placed teats are desirable in breeding stock.

The Middle White should be compact but not dumpy, and show plenty of character and vigour in its action and general appearance.

Hardiness of Middle Whites.

Whilst criticism is sometimes levelled at white-skinned pigs on account of their so-called "softness," we see them bred successfully from the south coast to the far north of Queensland, and even in the inland districts, with excellent results, and experience has shown that white pigs can hold their place with the dark-coloured provided they are given reasonable attention and kept free of lice and mange by oiling should the necessity arise.

Details of the pedigrees of the imported pigs of the Berkshire and Middle White breeds, which were selected by the best available judges in England, and are said to represent the best of the British herds, can be obtained from the Department of Agriculture and Stock, Brisbane.

REARING PIGS WITHOUT THE SOW.

Newly-born pigs are frequently deprived of the sow's care through death or sickness, or because the litter is too large. If taken in hand as soon as they are deprived of the sow's milk there is a very good chance of the pigs being reared successfully by artificial feeding. If they are left too long without sufficient food, however, they become weakened and difficult to rear.

Sometimes a large litter is divided into two lots, and each lot is put with the sow separately for a drink at frequent regular intervals. Although this entails a lot of attention, it gives satisfactory results. Foster mothers are sometimes available, and a sow with a small litter may be given some pigs from another sow, provided they are about the same age as her own.

When hand feeding is resorted to the pigs should be given a warm, dry camping place, and have access to clean pasture. A movable shed in the run is very convenient. In the absence of the sow's milk, which helps to build up a natural resistance to disease, every possible precaution should be taken to prevent infection in the young pigs. A clean and comfortable pen should be a first consideration. Access to pasture assures a supply of vitamins and minerals, which are essential to a complete diet.

A method of feeding which has given very good results with pigs taken from the sow when a day or two old is as follows:—Start the pigs on whole cow's milk fed warm and as fresh as possible, six times daily. After three weeks the whole milk may be gradually replaced by separated milk, and the six feeds daily may be reduced gradually to three feeds daily. When the change from whole to separated milk is being made, a trough of a dry meal containing 90 per cent. of pollard, bran, maizemeal or wheatmeal, and about 10 per cent. of meat-meal should be kept in the pen with food always available to the pigs. This trough must be sheltered and kept dry. A constant supply of drinking water should also be kept before the pigs when they are given the dry food.

In teaching the young pigs to drink, the bottle and teat are neither necessary nor desirable—a shallow dish serves the purpose well. The warm milk should be placed in the dish about ½ inch deep, and the pigs taken one at a time and stood in the dish. Then if the pig is held firmly over the top of the neck its head can be placed down into the milk and held there long enough for it to get a taste of milk, but not long enough to allow it to inhale the milk. This operation may be repeated a few times at each feeding. After two or three such lessons the piglets will usually drink readily without assistance and afterwards will give little trouble.

When the piglets are drinking well the dish may be replaced by a shallow trough. Both the dish and the trough used for holding the milk should be made of metal or earthenware and free of cracks so that they can be cleansed and scalded after each meal. This is most important for the prevention of digestive disorders.

—*L. A. Downey, Instructor in Pig Raising.*

The Rearing of Chickens.

J. J. McLACHLAN, F.B.S.A., Poultry Inspector.

THAT the rearing of chickens is one of the most vital subjects in poultry-farming is a statement the truth of which will be conceded generally. To be successful in that industry, a flock of well-grown birds, suitable as future breeders, must be raised annually. Although the parent stock may be quite typical, their offspring will be an unknown quantity until maturity is reached and, during their development, they can be made or marred by good or bad management.

In preparing for the arrival of the chickens, first consideration must be given to the housing of them. The use of a laying house is preferable to the building of a special brooder house. The latter would be used only for about four months each year, and to that extent the farm would be over-capitalised. On the other hand, a laying house need only be empty for about four months every two years.

When an old laying house has to be used, care should be taken to put it into a perfectly sanitary condition. If the floor of the laying house is of concrete, burning with a blowlamp will give good results. At the same time it would be as well to make sure that the woodwork is free from external poultry parasites, such as mites or ticks. The woodwork should be painted with creosote. Should the building have an earth floor, the best method of putting it in a good, sanitary condition is to remove a few inches of the earth, replacing it with fresh earth, making sure that the level of the floor is at least four inches above the level of the surrounding land. Care should be taken to see that the drains around the building are deep enough to carry off all flood waters, because chickens cannot live and thrive on damp or wet floors.

If an old building with a netted run attached is used, it will be a decided advantage to turn over the soil and plant some crop. This should be done as soon as the pen is empty of fowls, and if Japanese millet were planted, the chickens would have ample greenstuff, and at the same time be able to eat the grain, by which rearing costs would be lightened.

If second-hand brooders are used, they should be put into a sanitary condition, and for this purpose a blowlamp should be used, as heat will be more effective than disinfectants.

Two Systems of Brooding.

There are two systems of brooding—the heated and the fireless. Brooders that supply the chickens with artificial heat will give better results on the average. Different types of battery brooders, usually heated, also are coming into prominence. With these machines, the chickens have a very restricted run on a wire-netting floor for about four weeks, after which they are placed on the ground in a house. The feeding and drinking utensils should be cleaned, and, if possible, disinfected in the same manner as the brooders.

Having everything in readiness, and in a good sanitary condition, the question of the number of chickens to be reared in each unit has to be considered. It is advisable to keep chickens in small units—preferably in lots of 100, with a maximum number of 200 under one brooder. If

using a laying house that is to accommodate 100 layers, a temporary division of netting should be run down the centre, and 125 chickens put in each section. From this it may be anticipated that the necessary number of pullets would be raised.

Just before the arrival of the chickens, the floor should be covered to a shallow depth with litter such as chaff, sawdust, shavings, or any similar material. Under the brooder an opened-out sack on which sand has been sprinkled may be placed, this material being preferable to litter in heated brooders on account of fire risks. The brooder should be warmed up for a couple of hours prior to the chickens being placed in them.

When the chickens are under the brooder, they should be restricted to a distance of about 6 inches around it. This is best done by circling the brooder with wire-netting. They should now be supplied with clean, cool water. The vessel should be of a kind that permits ample drinking space for the chickens and, at the same time, does not allow them to get wet. Coarse sand and shell-grit should be provided in small trays. Another essential is wood charcoal, and this should be provided in a granulated form in trays. The water, grit, and charcoal should be available to the birds at all times throughout their life.

Feeding Methods.

So far as feeding is concerned, the usual practice is to place the chickens under the brooders direct from the incubators, and to withhold food from them until the next day. The kind of food and method of feeding have an obvious influence on rapid growth.

In my opinion, the all-mash system of feeding dry in troughs will give the best results. An all-mash that has proved suitable is as follows:—Maizemeal, 40 lb.; bran, 20 lb.; pollard, 20 lb.; dried butter-milk, $10\frac{1}{2}$ lb.; meat and bone meal, $7\frac{1}{2}$ lb.; fine salt, 1 lb.; cod liver oil, 1 lb. This ration gave excellent results in experiments conducted by the Department of Agriculture and Stock, and since then the majority of commercial poultry farmers have adopted this method, or are feeding ready-mixed all-mashes based on the experiments mentioned. By placing the mash in shallow troughs, with a piece of netting fitting loosely inside the trough on top of the food, wastage is prevented. It is a good practice to put out only a small amount of mash, and, on each visit to the chickens, to add a little more. This will encourage the chickens to consume more mash, and thus make rapid growth.

To lighten work in this direction, it will be found more convenient to have a kerosene tin of mash in each pen; then the "little and often" practice of feeding will not be neglected. A big factor towards the success of dry-mash feeding is the provision of ample feeding space.

During the first week troughs about two feet long by six inches wide and $1\frac{1}{2}$ inches deep will be ample for 100 chickens. Afterwards the troughs should be about three inches deep and from four to eight feet in length from the second to the sixth week. The length of the hoppers has not been increased in accordance with the rapidity of the growth of the chickens, because it is expected that farmers will commence removing the cockerels as soon as the sexes can be determined.

The ration mentioned is for those persons who are compelled to purchase all foodstuffs. In the event of farmers having suitable food stuffs available, these should be used to advantage. For instance, if

milk is available, the dried buttermilk could be eliminated from the ration. In feeding milk, it is best given in the form of dry curds—that is, with the whey strained. Liquid milk adheres to the feathers, and when the chickens are under a heated brooder it gives off a sour odour, and the fact that special care must be given to cleaning the vessels containing milk is my reason for preferring to feed curds.

As soon as the chickens have become accustomed to feeding, green feed can be supplied. The greens should be young and succulent, as foods of a fibrous nature are quite unsuitable for young chickens.

In the daily routine work, for the first week the brooder lamp should be kept burning; this should apply also on wet or cold days. In working with lamp brooders, it is a wise policy to place a windbreak, such as a sheet of iron, in front of the brooder each night to prevent ground draughts. After the second night, the droppings must be cleaned up every morning, and the sack cleaned and sprinkled with fresh sand. The water vessels should be cleaned out daily, a piece of sacking or brush being used for this purpose.

Care should be taken to avoid spilling water on the floor where chickens are being reared. This can be done by washing out and filling the drinking vessels outside, and carrying them into the pens. Again, if the floor around the drinking vessel gets wet, a frame having a netted top might be made to cover this wet patch, and the drinking vessel placed on it. Wet places on the floor are spots where disease organisms and worm eggs can be picked up, and this danger should be guarded against.

Daily Routine.

The daily routine work must be carried out carefully, the mash and greenstuff being supplied constantly. The grit tins should be kept well filled and an ample supply of clean, cool, fresh water always available, the vessels being kept cleaned out thoroughly.

The brooder lamp must be filled, and the wick trimmed, care being taken to clean off all the carbon from the wick and burner. The gauze below the wick must be clean always, as this regulates the amount of air admitted into the burner, and should this be choked up with dust, the lamp may commence smoking, and would be liable to catch on fire.

During the first week, the chickens should be confined fairly close to the brooder, to teach them where the warmth is, but after that they may be permitted as much liberty as possible. A good run is decidedly beneficial to them.

After the first week, the brooder lamp can be put out in the morning, and relit at about 4 or 5 o'clock in the afternoon, according to climatic conditions. When the chickens are about three weeks old the weaning process may be commenced by reducing the flame gradually so that, when there are only from four to five, there is no need to light the lamp. This is a simple and satisfactory method of weaning them in heated brooders. It is wise to leave the brooder and lamp in position, as the chickens then will camp under the hover. If the hover is removed. they will be liable to crowd. For that reason the chickens should be trained to use the perch before the brooder is removed.

When the chickens have learnt to perch at about six weeks of age the feed can be changed from the all-mash ration to a growing mash and grain. The following is a growing mash that can be fed in

conjunction with equal parts of wheat and finely-cracked maize as the evening meal:—Maizemeal, 25 lb.; pollard, 40 lb.; bran, 20 lb.; meatmeal, 5 lb.; linseed meal, 2 lb.; dried buttermilk, 4 lb.; bonemeal, 2 lb.; fine salt, 1 lb.; cod liver oil, 1 lb. A liberal supply of young, succulent, chaffed greenstuff should be given as a midday meal. This ration could be continued until the pullets are about sixteen weeks old, when a change should be made to the laying mash.

Losses through Sickness.

More chickens are lost annually as a result of chills than from all other causes put together. Even in the case of chickens dying from specific diseases, it probably is true that 90 per cent. of the deaths originated in chills which first weakened the birds and laid them open to other diseases. No treatment can be recommended except the exercise of care in keeping the chickens warm and encouraging them to eat more food, although the supplying of a little milk to drink might strengthen them.

Another annoying trouble is cannibalism, which may take the form of toe-pecking or tail-picking. These vices may be attributed to shortage of food and inactivity. Affected birds should be removed, and the affected parts painted with Stockholm or coal tar. The birds should then be put in a dark place for about half an hour before being returned to their pens. To prevent further outbreaks, their attention must be directed away from the vice. Ample litter must be placed in the pen. In cases of toe-pecking, shavings or chaff should be used. The toes of the chickens will sink into such materials. For tail-pecking, straw should be placed in a heap in the centre of the pen, and the chickens will be so occupied in spreading it out that they will forget their bad habit.

A CLOTHES TROLLEY.

This trolley, which the housewife will find most convenient for taking clothes to the line on washing day, can be made from a large packing case and two old perambulator wheels. The axle is the only article to be bought. Buy a length of round iron from a blacksmith and get him to put a thread on each end. Shape two long boards for the sides as in the sketch, and when these are joined with two shorter pieces to make a shallow box connect the ends of the shaped pieces with

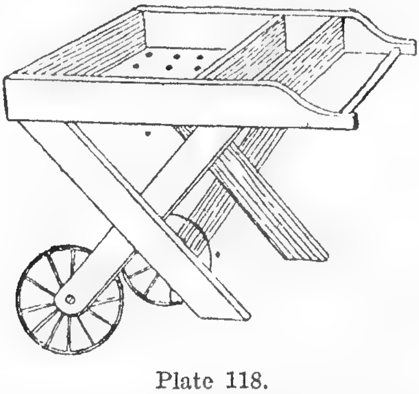


Plate 118.

part of an old broom handle. The large compartment, which has holes drilled in the floor to let the water out, is for the clothes, and the smaller one for pegs. Crossed legs are fitted on either side, and the wheels are attached to the ends of the pair which come from the back, or handle end. A length of galvanised piping, or a long piece of wood with a hole bored through the centre, keeps the wheels in their place on the axle, and a nut on each end secures them on the other side.

History of the Australian Sugar Industry.

IN an interesting paper on "The History of the Australian Cane Sugar Industry," read before the Historical Society of Queensland recently, Mr. F. C. P. Curlewis, general secretary to the Australian Sugar Producers' Association, traced the first record of the growth of sugar-cane to India 600 years prior to the Christian era. In 327 B.C. the first European reference to it was made by Nearchus, an admiral of Alexander the Great, and subsequently its production went through Persia, Arabia, and Egypt, and later to Spain and Portugal. The Chinese also were acquainted with the sugar-cane in the very remote past.

Some sugar-cane plants actually were brought to Australia by ships of the first fleet in 1787, having been shipped at the Cape of Good Hope. Nothing, however, was heard as to the cultivation of sugar-cane in Australia until about 1822, when Thomas A. Scott established a plantation near Port Macquarie, and (in 1824) manufactured a few tons of sugar, as well as some rum.

It is interesting to note that, precisely 100 years later (in 1924), Australia first entered into the overseas export trade in sugar. The cultivation of sugar spread to the northern rivers of New South Wales, plantations and mills being established on the Bellinger, Clarence, and Richmond Rivers in the late sixties of last century.

First Queensland Planting.

The first record of the cultivation of sugar in what is now Queensland was in 1836, when an East Indies planter named Mayo planted a few acres near Brisbane with cane which had come from Mauritius. It, however, was not until the sixties that an attempt to manufacture sugar by Thomas Bowden, in the vicinity of Brisbane, is recorded.

In 1862 John Buhot, who is said to have gained his experience in Mauritius, actually succeeded in making sugar from cane grown in the Brisbane Botanic Gardens. The available appliances were crude in the extreme, and it is said that actually the sugar was made in a domestic saucepan.

In the following year Captain the Hon. Louis Hope had 20 acres under cane at Ormiston, near Cleveland. It was there that the first sugar mill was built, and commenced operations in 1865, the first ton of sugar from the mill being sold by auction in January, 1866. During the visit of members of the International Society of Sugar Cane Technologists in September, 1935, Captain Hope's title as the father of the sugar industry in Queensland was recognised by the formal dedication of a monument to him on the site of the old mill.

Sugar-cane was introduced in the early days from Java and Mauritius, and some years later several varieties were brought from New Guinea by Mr. H. Tryon, an officer of the Queensland Government. One of these varieties (Badila) has played an important part in many of our canefields since.

As the outcome of encouragement given by the Government, nearly 2,000 acres had been taken up in 1865 under what were known as the Sugar and Coffee Regulations, but it was not until 1867 that the manufacture of sugar was regarded as a commercial enterprise.

Sugar Cultivation Spreads.

By 1870 no fewer than twenty-eight sugar mills were operating in Queensland, mostly in the Albert and Logan districts, and developments gradually spread northward to the Mary and Burnett Rivers, later reaching Bundaberg, Mackay, and Ingham, and subsequently the Johnstone River, Cairns, and Mossman in the late seventies and early eighties.

As many as eighty-three mills had been established by 1880, most of them in Mackay and adjacent districts, the total output of sugar for that year being 15,564 tons. The greatest number of mills operating at one time was 166 in 1888, with an output of 59,000 tons of sugar. Of these, only twenty-two were established in the northern districts—that is, from the Burdekin district to Mossman—because, as the industry developed in the northern areas, the policy of larger mills with separately-owned cane farms, rather than attached plantations as the source of supply, was being recognised as a surer method of opening up and populating North Queensland.

Co-operative Control.

During the early eighties a strong agitation against the employment of kanaka labour in the canefields was carried on, and in 1885 Parliament was petitioned for Government assistance in the establishment of central mills, one of the arguments used being that only through the agency of farmer-owned manufacturing plants would it be possible to make canegrowing a white man's industry. As a result, sugar mills were erected at North Eton and Racecourse, in the Mackay district, for which £50,000 was advanced, and provision made for its gradual repayment. Under the terms of the Sugar Works Guarantee Act passed in 1893, central mills were built in eleven centres scattered along the coast from Nerang to Mossman.

After many vicissitudes the whole of these, with the exception of Nerang, are working still. Half a million sterling was advanced by the Government at that time as loans to the farmers in the respective districts. The farmers lodged their deeds as security for the repayment of principal and interest, and the loans were to be repaid over a period of fifteen years. In the event of default, the State Treasurer was entitled to enter into possession of the sugar works as well as of all the lands mortgaged, and to fix the price of cane.

The Mackay District.

The farmers' co-operative mills system received a greater impetus in the Mackay district than elsewhere and prior to federation Mossman (1897), Mulgrave (1896), and Proserpine (1898) were the only central mills established north of Mackay. The main reason for this, of course, was that conditions of living, in those early years, were less attractive to permanent settlers than those obtaining in Mackay and Bundaberg. Later on, when new sugar districts were required, they were all opened up north of Mackay, and co-operative central mills were established at Babinda, south of Cairns, and at South Johnstone and Tully, south of Innisfail.

When Federation became an accomplished fact, a "White Australia" was accepted as a definite policy, and adequate protection was promised to the sugar industry. A duty was imposed by the Commonwealth Government on imported sugar, and an excise duty on sugar

manufacured in Australia; and from this excise a rebate was paid on all cane produced by white labour. By 1907 most of the kanakas had disappeared and, from then on, the industry, under white labour conditions, was faced with regulations and awards in respect to wages and the general conditions of the employment and accommodation of the workers. The first award by an Industrial Court was made in 1914. Incidentally, there were strikes of a more or less serious nature; but, viewing the subject as a whole, it may be said that, whilst the wages awarded by the Court appeared to be unduly high, they eventually attracted a class of labour that has contributed, not only to the efficiency of the industry, but also to the satisfactory type of settler and settlement that has spread through the north-eastern littoral of Australia.

Regulation of Cane Prices.

Seeing that the employees had secured protection by means of industrial awards and regulations, it was not long before the growers supplying both proprietary mills and central mills put in a claim for some method of determining, under statutory authority, the value of their cane. For this purpose the Regulation of Sugar Cane Prices Act was passed by the State Parliament in 1915 and, under its provisions, a tribunal was created with final authority to allocate to each mill the lands from which it should draw its supply of cane and to determine the value of the cane delivered to the mill. This tribunal, known as the Central Cane Prices Board, consisted of a Judge of the Supreme Court, one representative of the millowners, and one representative of the canegrowers, and it is the final board of appeal from the decision of Local Boards that primarily determine values in respect to the cane delivered to each mill. The system then inaugurated has been in force since 1915 and, on the whole, it can be said to have been satisfactory.

Effects of the War.

On the outbreak of war in 1914 the Commonwealth Government immediately placed an embargo on the export of sugar from Australia. Simultaneously, the State Governments, through their price-fixing authorities, took steps to keep the price at normal levels. The result was that the sugar industry did not share in the high world prices that fell to the lot of the established exporting industries. Australia was not producing enough sugar at that time for its own requirements, and importations had to be made at values that, as a result of the war, reached £98 per ton and averaged over £40 per ton, whilst the Australian raw sugar was made available at £21 per ton. The only labour procurable in the country at that time was costly and unreliable, and prices of capital and consumption goods were high; consequently, by the end of 1919, the sugar industry was in a really bad way. Due to the necessity for importing sugar, the Commonwealth Government had taken complete control of the industry so far as distribution and the fixation of prices were concerned, and strong representations were then made as to the serious position to which the industry had fallen. The result was that, in 1920, the Commonwealth Government agreed to place an embargo on the importation of sugar and to increase the price of sugar over a period of three years to such a figure as would enable the industry to get on a sound footing again.

This increased price gave a definite fillip to the industry, and the revival that followed was maintained when, at the expiry of the first

agreement, it was renewed as regards conditions, though the price of raw sugar was reduced by about 11 per cent. About this time the Commonwealth Government relinquished direct control of the industry, and all its subsequent economic conditions have been regulated under an agreement between the Government of the Commonwealth and the Government of the State of Queensland, whereby the Commonwealth on the one hand agrees to impose an embargo on the importation of sugar, whilst the State Government agrees to provide sugar at such a price as will enable the consumer to obtain it at a definite price over a term of years. These agreements have been renewed from time to time, and the price to the consumer remained at 4½d. per lb. for many years, but a reduction to 4d. per lb. was secured by an amended agreement in 1932. Recently this agreement was renewed until the crop of the season 1940 is disposed of.

Export Market.

After the renewal of the third series of these agreements, about 1925 or 1926, it was realised that great developments were taking place in many sugar districts—that production had overtaken consumption and that there was likely to be a surplus every year, necessitating the securing of an export market. This special market was created, almost coincidentally, by the policy adopted by Great Britain of granting preferential treatment in import duties to Dominion products. Hence, the industry entered upon export trade at low values, but with the definite knowledge that it would have to be limited, first, by the reduction created in the average value of the Australian crop; and, secondly, by the preferential requirements of Great Britain. This idea has been haunting the leaders of the industry for many years, and steps have been taken to control production, with the result that, under present conditions, any increase is due chiefly to favourable seasonal conditions, though extra efficiency in production, both in field and mill, is responsible for some of the present output of sugar. The increased production, of course, has added to the employing capacity of the industry and, consequently, there has been a natural reluctance on the part of Governments to create any more unemployment by statutorily reducing production.

Under the International Sugar Agreement finalised in May, 1937, as an outcome of a conference of the principal sugar-producing and consuming countries of the world, Australia is limited to an annual export quota of 400,000 tons and, in addition, the British Government have intimated that they will introduce into Parliament a measure providing for the maintenance of the present preferential duties on Empire sugar. These two factors introduced some stability in the industry, and the limits of our production are now definitely known.

Modern Machinery.

With the passage of time methods of cultivation, crushing, and transport have progressed steadily from the primitive to the most up-to-date. When, in 1916, wages began to assume a heavy item in production costs, an impetus was given to the development of labour-saving devices, such as weeding machines, and cane planters, &c., and, with the introduction of tractors, the use of heavier field machinery was made possible. Now, on the larger farms, it is usual to find two- and three-disc ploughs, grubbers, and double row cultivators. The very

latest machine introduced is the Gyrotiller, which, for all practical purposes, takes the place of a plough, roller, and harrow in turning over and pulversing the soil in a single operation in preparing for the planting. Machines for harvesting cane have been the subject of much study for many years, and three types of machine have been constructed during the past ten years and have been put on preliminary trials. They have not yet reached practical application, though the latest—the Howard Harvester—is a possibility.

Transport is a very important factor in the complete picture of cane harvesting. Cane is a bulky commodity, and transport to the mill, or even to railway lines, by wagons and drays, was found to be definitely uneconomic. Consequently, there has developed a regular transport system under which the millowners purchased their own locomotives and laid down permanent railways, reaching out to the main sources of supply, using their own locomotives and rolling-stock. The cane is hauled from the fields to the main line on a portable line which, in some cases, is provided by the mill and, in others, by the individual grower himself. The transport of the sugar, in most cases, is carried out by Government railway to the shipping ports and thence by large or small steamers to its destination, as the case may be.

The irrigation of the canefields has become almost universal, on account of low rainfall, in the Lower Burdekin district, south of Townsville, and in the last few years much also has been done in the Bundaberg district, though mostly on the large plantations.

In sugar mill machinery, the industry has kept well abreast of the times, and, apart from the general desire for efficiency, contributing factors have been the high wages and the conditions of employment as well as the necessity, particularly in later years, for reducing working costs to meet the low average price received for sugar due to the large proportion of the output that has to be exported.

The organisation of technological research was probably initiated, and certainly very successfully developed, by the Colonial Sugar Refining Company Limited. Its milling work was closely followed by the technical men at other mills and, in field work research, the company's officers were, in the earlier years of this century, practically the only ones who were in a position to make intensive study on account of the fact that they had as a basis of observations and comparisons properties throughout all the principal cane-growing areas of Queensland, New South Wales, and Fiji. Whilst the Queensland Government assisted the industry by despatching departmental officers to New Guinea in search of new varieties of cane and by a general supervision as regards entomology and pathology, it was not until 1898 that a laboratory was erected at the Mackay State Nursery for the purpose of testing the qualities of cane under cultivation, with the idea also, at a later period, of analysing soils, manures, and mill products.

Sugar Experiment Stations.

This was the genesis of the present Bureau of Sugar Experiment Stations which was established by an Act of Parliament passed in 1900. The funds for the administration of this Act are raised by a levy on the industry of, at the present time, 1d. per ton of cane crushed at each mill, the miller and grower each paying an equal part of such levy. The Government originally subsidised this fund by a contribution equal

to the amount levied on the industry but, in recent years, its contribution is limited to £7,000 per annum. The Bureau is therefore now supported by the industry to the extent of substantially more than half of its total revenue.

For many years after its establishment the work accomplished by the bureau did not appear to be giving much result or even satisfaction to the industry, chiefly because, as the then Director (the late H. T. Easterby) pointed out, great difficulty was experienced in securing sufficient trained men to concentrate on the various branches of research required in this connection. It then was realised by the Director that the sugar industry would have to train its own men and, eventually, three three-year travelling scholarships were provided, open to University graduates. In due course these graduates returned to Queensland and are now doing most valuable work both in further research and in assisting the industry in its practical and technical problems.

Notwithstanding machinery and other aids to efficient and economic production, the worker and his labour is still the most important consideration, and, in fact, it is economically a subject in itself. The sugar industry is interested particularly because it is a large employer of labour, both permanent and seasonal. However, from a national point of view, it is satisfactory to note that, as the industry has developed, the nomad workers have decreased, and many of the seasonal workers and their families are making their homes in the sugar districts.

The refining of the raw sugar is the final process before the product is placed on the market for consumers. There are two refineries in Queensland—one at Bundaberg and the other at Brisbane—the latter is owned by the Colonial Sugar Refining Company, which also has refineries in Sydney, Melbourne, Adelaide, and Fremantle.

Population Figures.

Evidence of what the sugar industry has done towards the settlement of North Queensland is afforded by official figures. In 1901 the total population of Douglas Shire, Cairns town, Cairns Shire, Johnstone Shire, Cardwell Shire, and Hinchinbrook Shire, was 14,665. In 1911, it had only increased to 17,191. In 1921, in the same area, the population was 25,954, and at the 1933 census in the same area the population was 52,659. This was an increase of over 100 per cent. in twelve years. The sugar districts south of Townsville have also increased, though not to the same extent. In the same period—that is, between 1921 and 1933—the population of Queensland increased by 25 per cent., and that of the whole Commonwealth by 21·94 per cent., so it is clear that the sugar industry is making no small contribution to the factors of development and employment.

THE SOIL.

The soil not only gives us the harvest in due season, but it is the breeder of human character. It is natural to live in the open, to feel the warmth of the sun on the face and the sharp sting of the wind-blown rain.

If for nothing else than the part agriculture plays in the spiritual life of our race, it should be lifted up from discouragements which now beset it like a plague. —"The Farmer and Stock-Breeder" (England).

Marketing Strawberries.

JAS. H. GREGORY, Instructor in Fruit Packing.

QUEENSLAND has become known throughout Australia for its ability to supply high quality strawberries to the Southern States during their out-of-season period. Our single layer carton in which all fruit is open to inspection is now quite a common sight in Melbourne and Sydney.

The regularity of aeroplane transport has opened up new avenues of distribution, many western towns now being able to receive regular consignments of berries. As the strawberry possibly is the most tender fruit we have to handle, special methods of packing are necessary to enable it to be transported long distances successfully. Close attention, therefore, must be paid to all equipment used for marketing this delicious fruit.

CONTAINERS.

Many types of containers are used for marketing strawberries. In some of the Southern States a punnet is in general use, but as this has the disadvantage of containing more than one layer of berries with each layer resting upon the other, it is not as suitable as the single layer packed box in general use in Queensland. There are two types of boxes in use—one which measures 8 inches long by 4 inches wide by $1\frac{1}{4}$ inches deep—obtainable in either plywood or cardboard—and the other made of wood, 24 inches long by 8 inches wide by $1\frac{1}{2}$ inches deep measured clear of its central partition. The smaller of the two containers is preferable, because it allows less latitude for mistakes and for spoiling the appearance and alignment of the fruit when packing. Being smaller, the fruit is less likely to become loose in the box through careless handling, and so being damaged through rubbing and otherwise. It is also a better container for retailing. The larger box or tray, which contains the equivalent of six smaller boxes, may hold too much fruit for the average buyer when prices are high,

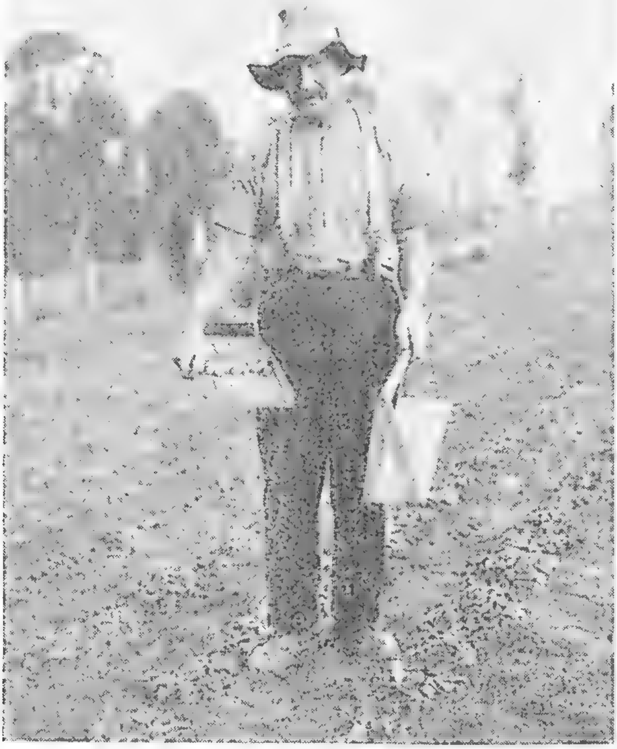


Plate 119.
Using the Picking Tray.

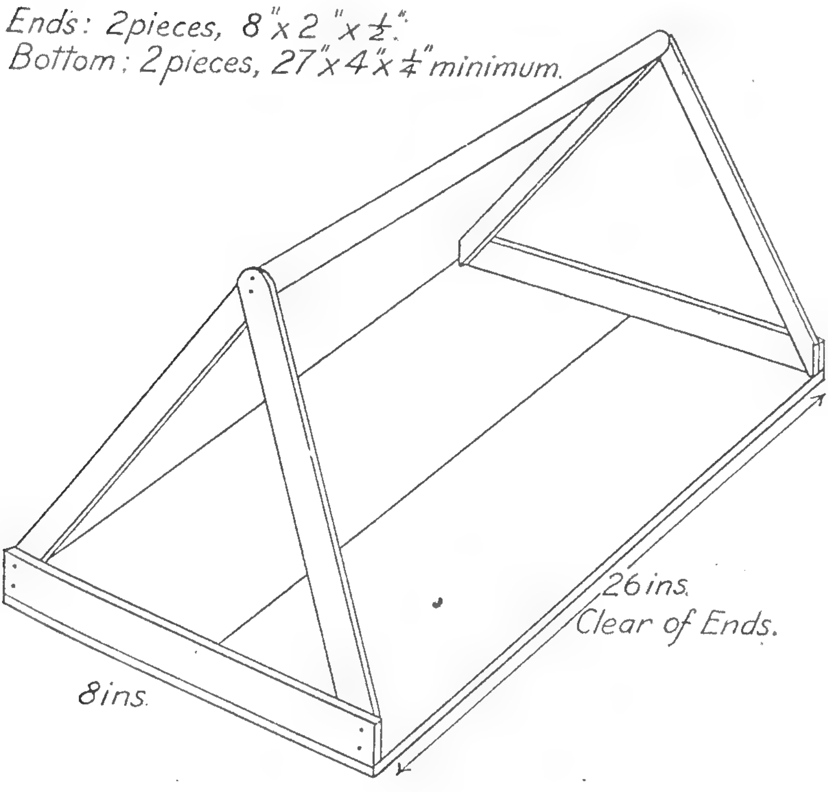


Plate 120.
Picking Tray Holder.

necessitating repacking into smaller boxes. As the strawberry is such a soft fruit, it is desirable that it should be handled as little as possible. The smaller container also has the advantage of allowing for better sizing and packing when the supplies of berries are short. Twenty of the boxes 8 inches by 4 inches by 1¼ inches will just fit comfortably into a half-dump case.

FRUIT PROTECTION.

Fruit should be cooled always before packing and when carried for long distances it must be kept at a cool, even temperature. Fruit should never be placed in the sun, or in places where it will become heated. Exposure to rain, dust, and wind must also be avoided.

PICKING.

Much time and handling can be saved by using a picking container. A good type of picking tray is illustrated (plate 122). An examination of the illustration will show that in addition to having a handle, the tray is fitted with two compartments. Another type is shown whereby an ordinary tray can be used (plate 119). When picking, the first grade berries fit for marketing are placed at one end of the tray, and second class or factory berries at the other. Where growers are picking for Southern markets, this method may be varied. The solid, full, three-quarter coloured berries for distant markets are placed on one end, while the full-coloured ripe berries, fit to send to the local market, are placed on one side of the other end. Jam fruit is placed on the other side of the same end as the local market fruit, being kept separate. The adoption of this system means a great saving in time and handling, as the berries are graded automatically for each market. It should be remembered that in the case of strawberries a saving of even one handling means a lot in increased range of travel and carrying capacity. Berries should not be picked or packed while wet, and all skin-damaged fruit should be rejected rigorously. Fruit that has come in contact with damaged berries also should be relegated to the "jam" quality. Care when picking will minimise the risk of damage to berries. Fruit should be handled as much as possible by the stalk only. It should not be pulled about or turned over in heaps while being handled, because the slightest damage to the skin means an opening for the entrance of rots.

The best method of picking is by using the thumb and fore-finger, the berries being pinched actually from the plant. A stem three-eighths to one half-inch in length should be left on each berry. Berries should not be thrown or dropped into the picking trays or boxes during handling. If the stalk is pulled out from the fruit in any way, the berry should be relegated immediately to the factory grade, as the skin around the stalk would be broken slightly.

HANDLING.

When using the small box or punnet, 8 inches by 4 inches by 1¼ inches, berries are packed for market in three packs—threes, fours, and fives across the box. In the tray 24 inches by 8 inches by 1½ inches the fruit will pack five, six, seven, eight, nine, and ten across. It is only during periods of short supply and high prices that it is recommended to pack tens. Nines and tens are sometimes packed together. Much time and labour is necessary to pack fruit so small,

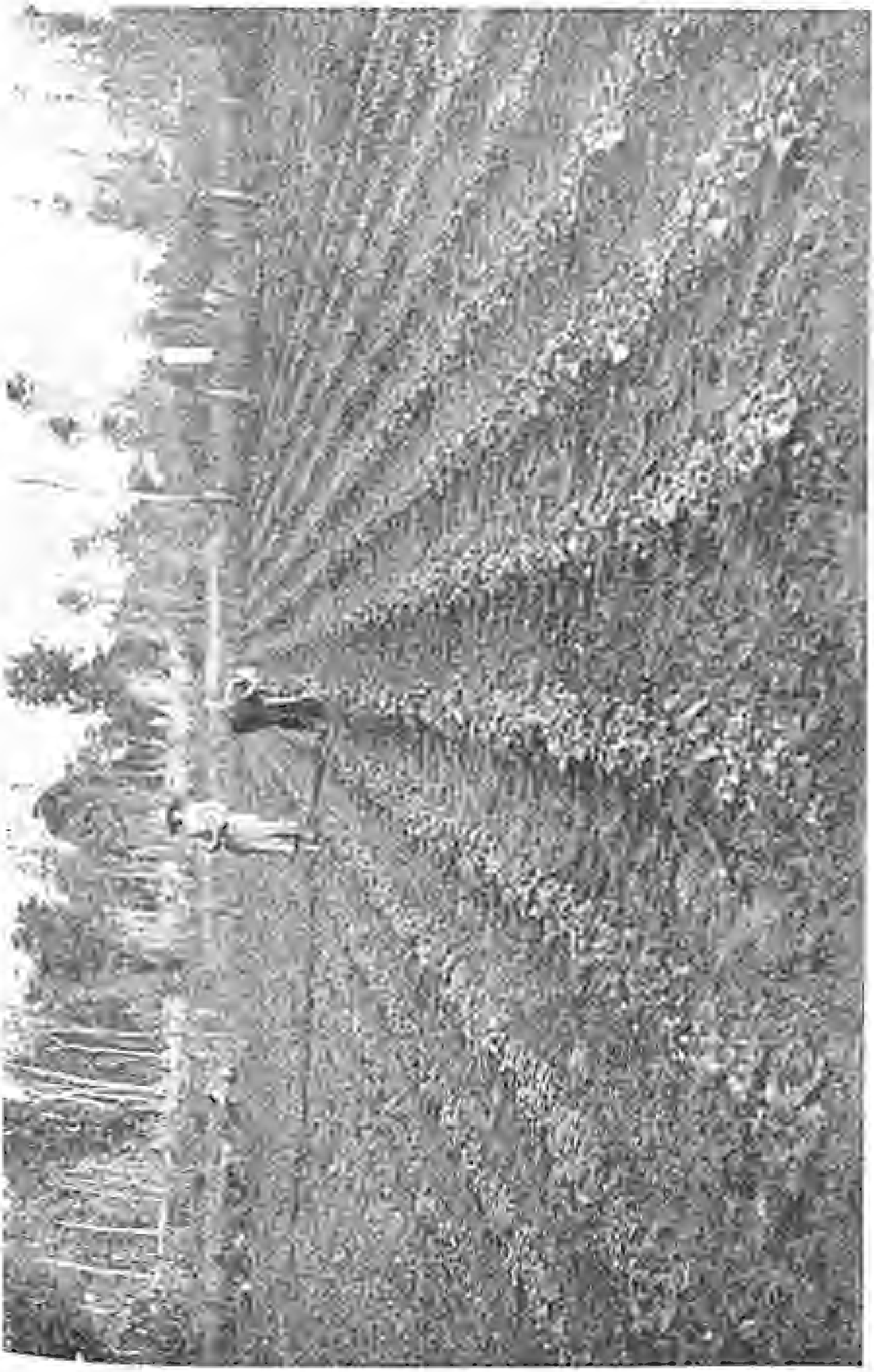


Plate 121.
A North Coast Strawberry Garden.

and even after packing it still looks a very second-grade article. Sizing is done while packing, the packer having a box for each size. Women and girls usually make the best berry packers, having, as a general rule, a lightness of touch which is often lacking in the case of men operatives. Berries with grains of earth adhering to them, as is the case often after rain, should be gently brushed. This is best done by placing a soft lacquer brush as a fixture, standing upright in the bench, and by taking the berry by the stalk and gently running it through the bristles of the brush. Brushing the fruit in this manner is quicker and more efficient than endeavouring to use the brush in the normal way.

PACKING.

The method of packing is simple enough. The box is first prepared by placing a prepared leaf across the end of the box (plate 123), (passion fruit leaves are very suitable, and, when these are not available, fern leaves sometimes are used); the leaf should project high enough to reach the top of the box, and at the same time be bent enough to place thereon the first line of berries—threes, fours, or fives, according to size. The berries should be placed on their stalk ends with the points up, allowing the point of the fruit to reach to the level of the top of the box. (See plate 124.) Another prepared leaf is then placed in the box, bent so as to rest on the bottom of the box to have the next line of berries placed thereon, while the remainder of the leaf rests against the first line of berries and acts as a separator of the lines of fruit. (See plate 125.) This process is repeated until the box is filled. For travelling, a layer of leaves or fern is placed on top of the finished pack to assist against damage (plate 131).

A study of the different packs in the boxes shows a variation in the count which can be placed in each box. The shape of the berries causes this variation:—

"Threes," 15, 18, and 21 to the box.

"Fours," 28 and 32 to the box.

"Fives," 40, 45, and 50 to the box.

The trays are packed on the same principle as the boxes, the greater width giving the extra number of berries across the end of the case.

For the best results the points to be watched are:—

See that the fruit is placed so that the tips will come as near as possible to the level of the top of the box without touching, and it will then keep snug when the lid is placed in position.

Avoid packing too high.

Keep the alignment of the fruit straight both across the box and from one end to the other. (See illustrations of packed boxes.)

Avoid placing too large pieces of packing leaves between the berries.

See that the berries do not rattle in the box after the lid is placed in position.

Keep all badly-coloured berries out of the box, as they spoil the commercial appearance of the package when displayed for sale.

On no account pack damaged berries, even those only slightly damaged will spoil the keeping qualities of the box. One bad berry will soon make a whole boxful practically unsaleable.

Keep the fruit dry and free from juice.

Grade to an even colour for each box.

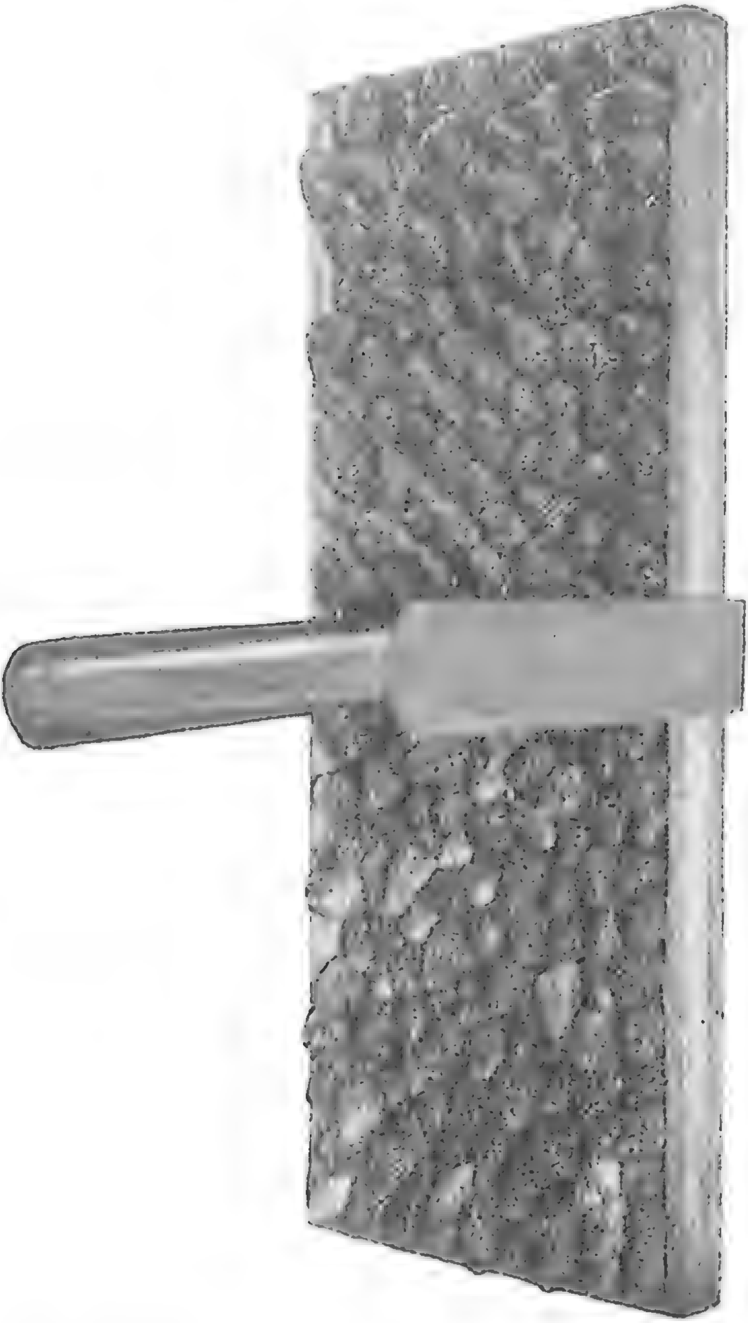


Plate 122.

PICKING TRAY FILLED WITH FRUIT.—Note the difference in colour of the grades of fruit in either end of the tray.

GRADING REGULATION.

The regulations governing the marketing of strawberries are as follow:—

"When strawberries are marketed in punnets, such punnets shall be marked legibly and durably on the top side and also

on the end of the bottom half of the punnet in which the fruit is packed with the name and address of the packer in block letters of not less than three-sixteenths of an inch in height. The following penalties are prescribed for any contravention of this regulation:—

(*a*) For a first offence not exceeding two pounds.

(*b*) For a second or subsequent offence not less than two pounds nor more than twenty pounds.''

All the necessary stamping of boxes can be quickly and easily done with rubber stamps. A set of rubber stamps covering all the requisite particulars can be obtained for a few shillings at any stamp makers. It is well worth while also to stamp the grade of fruit on the lid of the punnet.

DESPATCHING.

When packed, the small boxes, if being sent long distances, are packed in Australian dump half-bushel cases 18 inches by $8\frac{3}{8}$ inches by $7\frac{1}{8}$ inches, the case holding twenty boxes. If not all the one count, the details of the number of each count in the case should be placed on the end. This saves extra handling on the market section. For short transit to local markets the boxes are placed in bundles and tied together in their different sizes. Where a sufficient quantity of boxes is available it always is recommended that the boxes be packed in cases to send to any market. This allows the country order buyer to obtain fruit, knowing there is no necessity to pack it, and so creating a wider demand for consignments.

STENCILLING.

When stencilling, care should be taken to see that stencils are applied neatly, with no smeared edges. Using the stencil ink in conjunction with a handful of engineers' cotton waste to form a pad to absorb excess moisture is economical, and makes neat, clean stencilling easy.

When carting to the rail or market do not use the packed boxes as a seat.

PACKING-HOUSE HYGIENE.

Packing-house hygiene is most important if the risk of disease is to be reduced. Most transit troubles are caused through fungal infections. If fruit is allowed to lie about the packing shed and decay, the risk of infecting good fruit is greatly increased. The difficulty lies in the fact that infection is not noticed at the time of packing, but the development takes place during transit, to the detriment of satisfactory prices. All packing sheds should be thoroughly cleaned up after using, and occasionally sprayed out with a solution of formalin and water—one part formalin to twenty parts of water. All implements should be carefully cleaned and put away until again needed.

As the whole basis of successful marketing is care, growers should follow this principle right to the finish of their share of handling. Good packing, stencilling, &c., will not continue to sell bad fruit, and it is only by care in producing, handling, and marketing good fruit that one is able to meet competition and obtain satisfactory financial results. It must be remembered that the rule, ''the consumer is right,'' prevails as much in the fruit as in other industries.

HOW TO START TO PACK THE BOX.

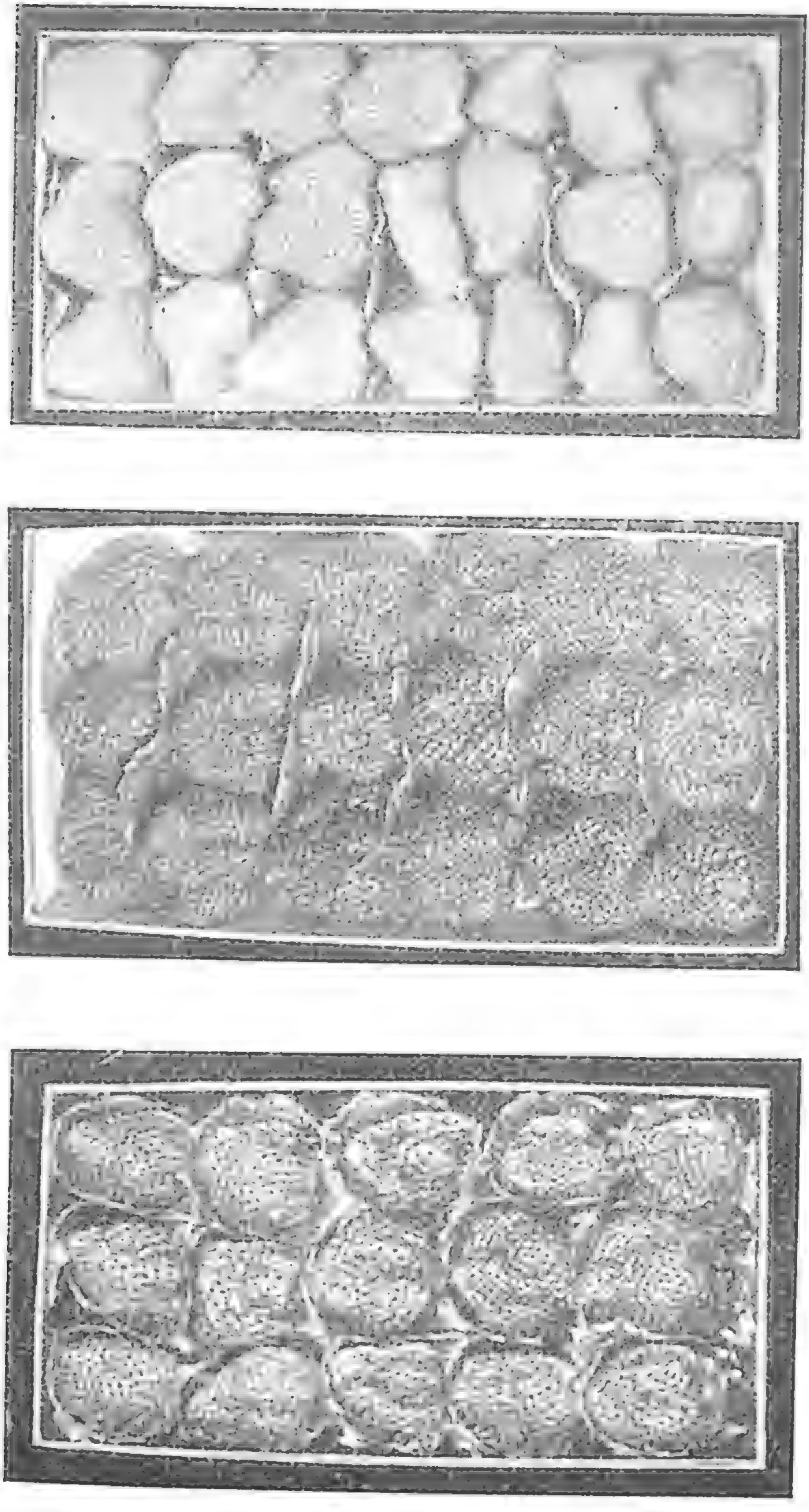
8 inches long, x 4 inches wide, x 1¼ inches deep.

Plate 123.
Leaf in position ready for the placing of the layer of fruit.

Plate 124.
First line of fruit in position.

Plate 125.
Starting the second line of fruit.

HOW TO PACK "THREES" IN BOXES.



21 Count.

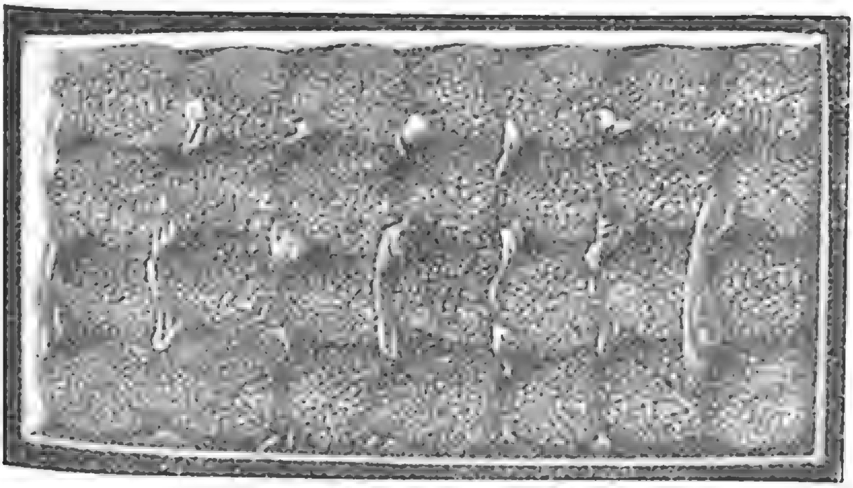
18 Count.

15 Count.

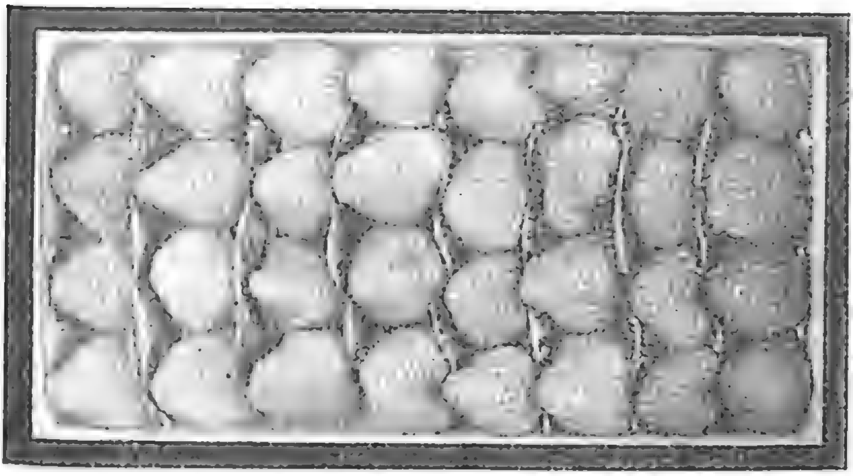
Plate 126.

Finished Boxes.

HOW TO PACK "FOURS" IN BOXES.



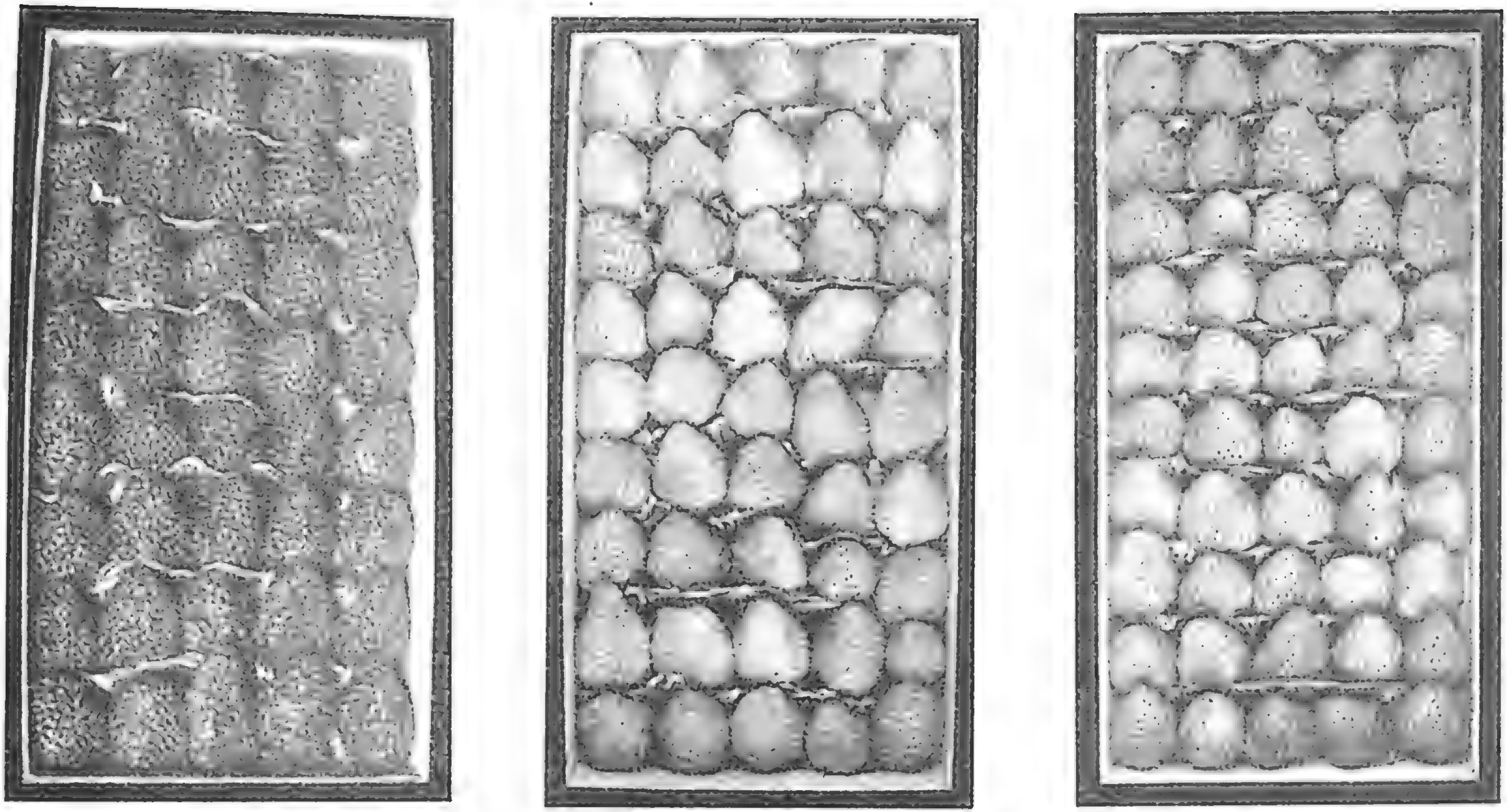
28 Count.



32 Count.

Plate 127.
Finished Boxes.

HOW TO PACK "FIVES" IN BOXES.



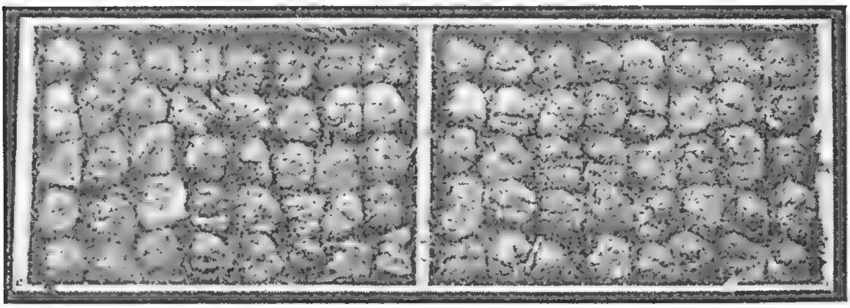
40 Count. 45 Count. 50 Count.

Plate 128.

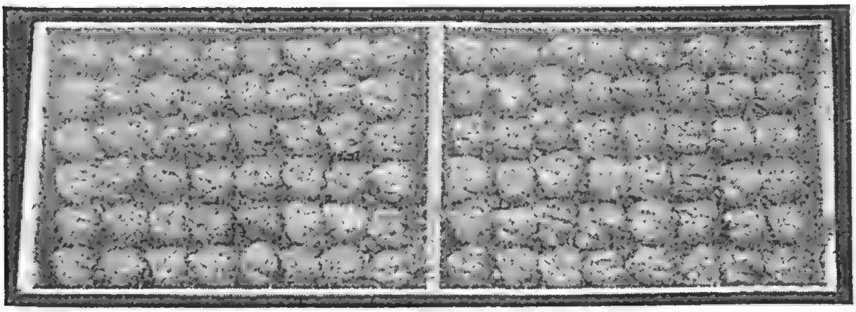
Finished Boxes.

HOW TO PACK TRAYS.

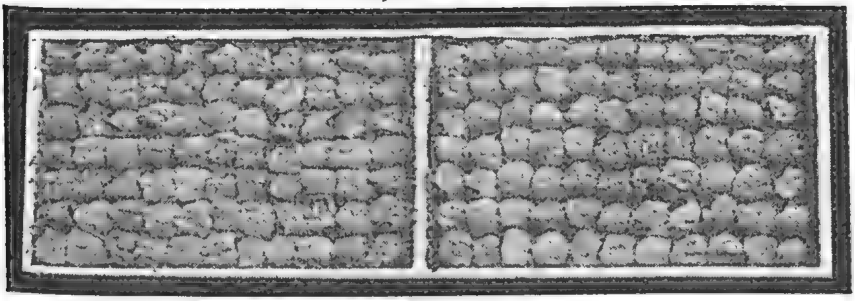
24 inches long, x 8 inches wide, x $1\frac{1}{2}$ inches deep.



Fives.



Sixes.

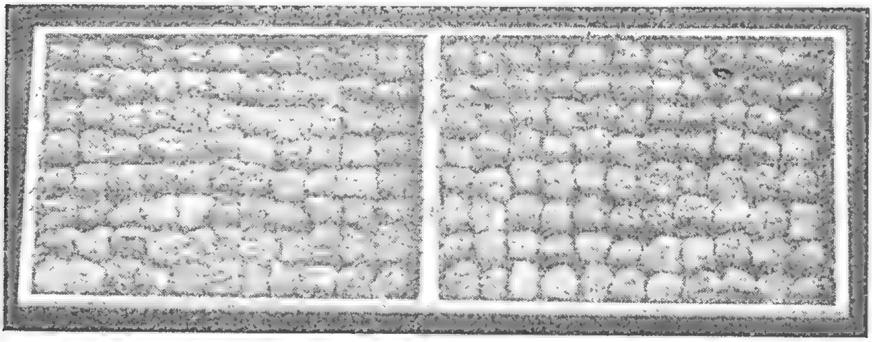


Sevens.

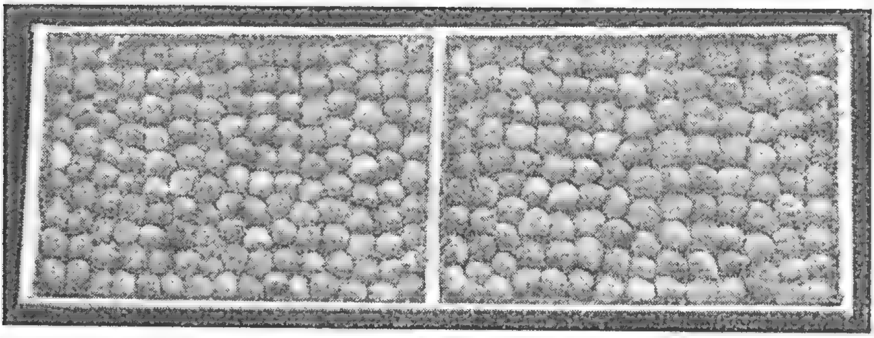
Plate 129.

Trays Packed for Market.

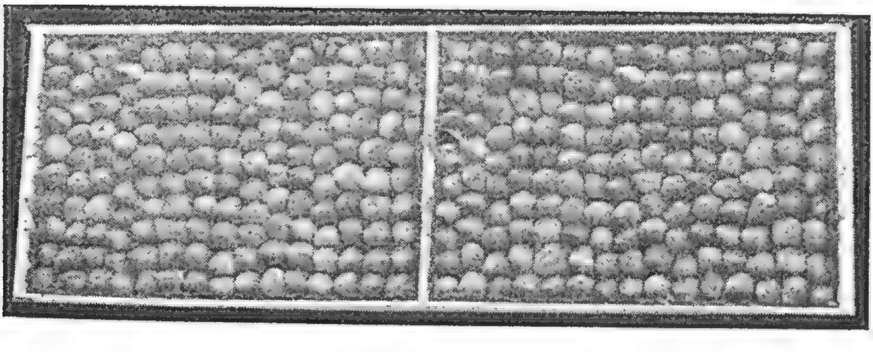
PACKING THE TRAY.



Eights.



Nines.



Tens.

Plate 130.
Trays Packed for Market.

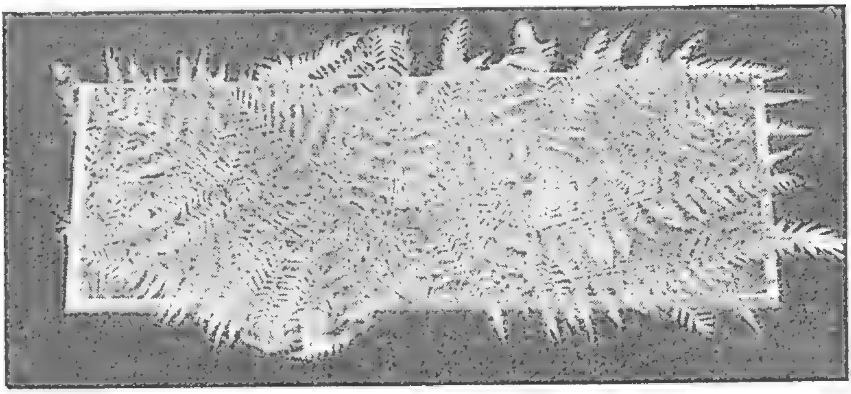


Plate 131.

Finished tray showing the placing of fern on the top of the fruit before placing lid in position. All protruding ends of fern are cut carefully after the lid is placed in position.

FACTORY GRADE FRUIT FOR SUPPLYING TO THE PUBLIC.

The use of a small box is recommended for this class of trade. A box holding 4 lb. to 6 lb. of fruit is desirable. Only sound berries should be packed. The fruit should not be stalked as it may be necessary for the retailer to hold the fruit during a quiet sales period. Each box should be lined with grease-proof paper before the fruit is placed therein. The net weight of fruit should be stamped on the end of the box. For supplies direct to the factory, containers may be obtained from the Committee of Direction of Fruit Marketing, Turbot street, Brisbane, with full instructions as to the quality of fruit required. As factory quality varies from year to year it would serve no useful purpose to describe present standards in this booklet.

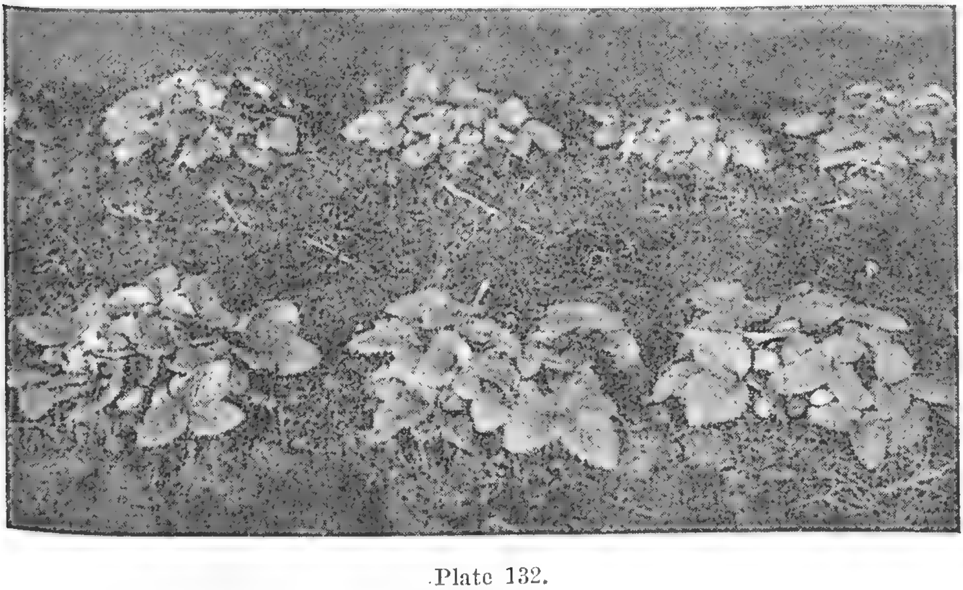


Plate 132.

A Ripening Harvest.

ACKNOWLEDGMENT.

Thanks are due to Mr. Coxhell, of Chevallum, for permitting the use of his fruit, and also the Eudlo District show exhibitors at Nambour who supplied the box of fifteen pack.

Some Tropical Fruits.

No. 17. THE SAPODILLA.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

THE Order Sapotaceæ contains a number of species, producing edible fruits; but the best known, and most highly esteemed, is the Sapodilla (*Achras sapota*, L.).

This fruit is a native of tropical America, in some parts of which it is reported to be growing abundantly in a wild state. From that region it has spread throughout most tropical countries. However, in spite of being regarded as one of the best indigenous tropical fruits of America, its cultivation has not been undertaken extensively in many other countries. Possibly the difficulty of propagation, and the very slow rate of growth, have been limiting factors in its commercial cultivation.

Macmillan states that the Sapodilla was introduced to Ceylon about 1802, but is met with yet only occasionally. In Queensland the writer knows of only one large tree and several small ones. One large tree also is growing in the Botanic Gardens at Rabaul, New Guinea. The Queensland specimen, although nearly twenty years old, has not fruited yet, but the New Guinea tree was bearing regularly for some years, although it has failed during the last year or two. The Queensland tree produced a crop of blooms early this year but shed them all. Possibly next year it may set some fruits.

The Sapodilla, as already mentioned, is slow growing, and trees raised from seed usually require about two years in the seed-bed and nursery before they are large enough to set out in the field.

The tree is of upright habit and forms a compact, shapely head. The dark green, glossy, and rather leathery leaves, of three to four inches in length clustered at the ends of the branchlets, give the tree an attractive appearance.

Authorities differ as to the dimensions attained by the tree. Whilst one quotes it as a small tree of 20 to 30 feet, another speaks of it as attaining to 50 to 75 feet. The Queensland specimen of fifteen to twenty years old is only about 15 feet high.

The flowers are small and white, and are produced in the leaf axils near the ends of the branchlets. In Queensland the flowering season was observed to be January-February. Whether a second crop will be produced here in the year, as is the case in several other countries, is yet to be provéd. It is reasonable, however, to expect that trees in North Queensland will carry two crops annually, as climatic and soil conditions are not vastly different to other tropical countries.

The fruit are reported to vary in size and shape on different trees; but are commonly from round to ovoid, up to about 3½ inches in diameter. The thin, russet-brown skin contains, when ripe, a yellowish brown, translucent, sweet flesh in which the shining black seeds are embedded. The fruit is a dessert one and seldom is prepared in any way. When thoroughly ripe it is said to be of delicious flavour; but, if not properly mature, it contains a milky latex which renders it unpalatable.

The plant is raised usually from seed which takes about five weeks to germinate. Vegetative methods of propagation have been tried in

various countries, but do not appear to be too reliable. Budding has been tried in America, and grafting, inarching, and layering in India, whilst in New Guinea marcottage is applied, and in Trinidad cuttings have been struck in special striking chambers. However, in spite of the multiplicity of methods used most authorities agree that vegetative propagation is difficult.

Plate 133.
Sapodilla Tree—A Queensland Specimen.

In Mexico and Central America the Sapodilla is grown largely for the production of a gum called Chicle Gum, which exudes from the trunk of the tree when incisions are made in the bark. Chicle gum forms the basis of chewing gum, the confection so popular in America. The production of the gum is quite an important industry in the countries mentioned, and Macmillan reports that the annual export from Mexico amounts to over 2,000 tons.

In addition to the term Sapodilla, this fruit is known also as Chico and Naseberry, whilst botanical synonyms of *Achras sapota* are *Sapota achras* (Mill) and *Sapota zapotilla* (Coville).

Cabbage-growing for Market.

C. N. MORGAN, Inspector, Diseases in Plants.

THE cabbage is one of the most important vegetables for the market gardener. It grows best in the cooler districts, but by selecting varieties carefully the crop may be grown in most parts of Queensland.

The seed should be sown in beds of well-drained, deeply and thoroughly worked soil. The soil, if heavy, should be improved by the addition of sand or decayed vegetable manure, and if poor and sandy the addition of a loamy soil or well-rotted manure will be beneficial.

The surface of the bed should be fertilized and firmed, and the seed sown thinly in shallow drills about 4 inches apart. After sowing, the bed should be mulched with well-rotted leaf mould to prevent excessive evaporation of moisture.

The seed-bed must be watered regularly, for a check in the growth of young seedlings is followed frequently by unsatisfactory results.

When large enough to handle, the seedlings should be thinned to an inch apart, for if grown too thickly they develop into long, spindly, weak plants.

Shading during the hottest part of the day is necessary in many cases; but this shade should be removed as soon as the plants are strong enough to withstand the heat. Overshading also produces spindly plants. Approximately 1 lb. of seed will provide sufficient plants for an acre of cabbage.

In about six weeks the young plants should be large enough for transplanting, and then can be hardened off by restricting water supplies for a day or two before their removal to the field. Transplanting should be done in cloudy or showery weather, but if conditions are not quite favourable the young seedlings should be watered in, and, as a further precaution, the top half of the leaves may be trimmed off to lessen transpiration until the root system is established.

The loosening of the soil in the seed-bed with a fork before lifting the plants helps to save many of the small roots. If the bed has been well soaked previously, the plants will lift with a ball of soil adhering to the roots, and this will help to keep them moist.

The roots of the young plants should be kept damp after removal from the bed by standing them in a bucket containing a puddle of soil and water.

In planting, a hole is first made in the ground with a dibble—an old spade or digging fork handle is suitable. The hole should be only deep enough to allow the roots of the seedling to reach the bottom of the hole. A little earth should be turned in and the plant drawn slightly upwards before pressing the soil firmly around it. This ensures that the main root will not be doubled up.

The plants should be in rows 3 feet apart. In the rows the smaller varieties should be spaced 2½ feet and the larger varieties 3 feet apart. The growth of cabbages should not be checked on any account, and for that reason regular cultivation and watering are essential.

Correct varieties should be selected for different times of the year. Winter-planting types should be early and quick maturing.

In the cooler areas, seed of the early varieties is sown during the months of February, March, and April. Main crop varieties are sown between August and December. The coastal districts are suited best to the winter crop, and seed for the main crop is planted generally during December and January.

Cabbage should be marketed as soon as possible after cutting, and only those having good firm hearts placed on the market. Care in handling is essential, and when packed in bags for railing they should be packed as firmly as possible.

Recommended varieties are as follows:—

Early.—Early Allhead and Early Drumhead, both of which are large, early, and quick growers.

Main Crop.—Succession is the most popular variety, and may be grown almost at any time. It is a good large Drumhead type.

Surehead is slightly larger than Succession. It is hardy, and may be planted closer in the rows, as it has fewer outside leaves.

A USEFUL IMPLEMENT.

A useful implement for levelling cultivated land, breaking sods and spreading

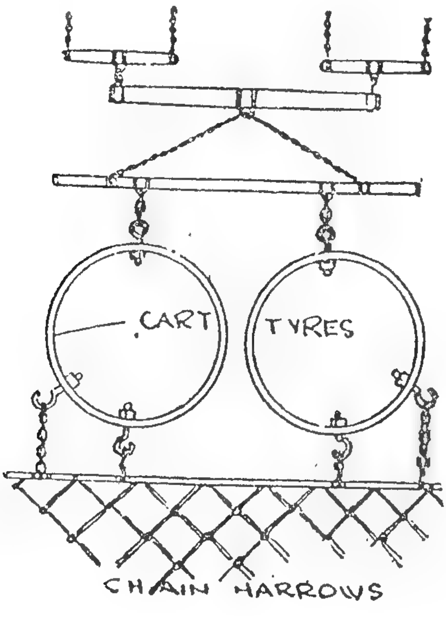


Plate 134.

cow manure, can be made from two old cart tyres, joined with ringed bolts and with hooked bolts for attachments. Any handy man can make these, and with the chain harrows attached they will do splendid work.

Plate 135.
Banana Country, South Coast District, Queensland.

Plate 136.
A North Coast Banana Plantation, Queensland.

Establishing the Avocado Orchard.

The increasing popularity of the avocado has brought this nutritious fruit recently to the notice of the commercial orchardist, and intending planters are at present considering the preparation of land for establishing orchards.

The avocado seems to be adapted to a variety of soils, the chief requisite being perfect drainage—stagnant water at the roots is fatal. The heavier soils seem to be more favourable to the growth of the tree than light sandy loams, but where possible moist medium loams should be selected for the crop.

The climatic conditions of the coastal foothill districts of Southern Queensland are generally considered satisfactory for avocado culture. Up to the present, it has not been the general custom to irrigate avocado trees. However, a wet spring is usually followed by a good crop and a dry spring by a poor crop. During the present season, only those orchards in which watering was practised have yielded good crops. The question of supplying water to the trees during dry springs therefore should receive consideration.

Avocado trees will only thrive in frost-free, well-sheltered, warm situations. In districts where the prevailing winds are such as to interfere with the normal growth, belts of standing scrub should be retained as a protection to the orchard. As an alternative, artificial windbreaks may be required. The site should be an area of unbroken land, nearly level or with a gentle slope. Steep hillsides should be avoided on account of the danger of sustaining irreparable losses by soil erosion.

The preparation of the land should be thorough. All stumps and roots should be removed to a depth sufficient to ensure that they do not impede cultivation. The land should be skim ploughed and then cross ploughed and harrowed. In that way rubbish and roots can be collected and burnt. When the weeds are eliminated, the land should be cultivated as deeply as possible, and the soil worked down to a fine tilth. Where practicable sub-soiling is desirable, as it facilitates root development.

In Queensland, it is usual to plant on the square system, though on hillsides a form of contour planting is preferable. The trees are spaced 25 feet apart, which permits of seventy being planted to the acre. The young trees should be planted so that the point of union between the bud and the seedling stock is slightly above the soil level.

A liberal watering is necessary after planting. The ground around the young trees should be kept liberally mulched with any coarse material which is not liable to pack and form a layer impervious to air and water. Spring planting is customary, though trees planted towards the end of the wet season (February to March) after the hottest period of the year have done equally well.

Numerous varieties have been introduced into Queensland, but many have been discarded for various reasons. Trial plots recently have been planted and those varieties which promise to be suitable are being worked up and kept under observation. Although at present no definite recommendations can be made, intending planters should confine their selection to varieties such as Blakeman, Grande, Goodwood, Queen, Spinke, and Wilsonia, which from the date at present available appear suitable for coastal foothill plantings for Southern Queensland.

R. L. Prest.

VEGETABLE CROP ROTATION.

The necessity for the rotation of crops in any particular plot of land must be plain to every observant market gardener. Not only does crop production fall off when the same crop is planted several times in succession, but pests and diseases frequently become worse in each succeeding crop.

In working out any system of rotation the following general rules may be taken as a guide:—

Plants belonging to the same natural order should not succeed one another. For example, tomatoes, potatoes, and the egg plant belong to the same order, and therefore should not be grown after one another in the same land.

Plants grown for their roots or tubers should not be succeeded by others grown for the same purpose, as, for example, carrots, turnips, and beet.

Crops occupying the soil for a long period should be followed by quick-maturing crops.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

BRISBANE marketing arrangements during the month were unsettled somewhat by the holding of the Royal National Society's exhibition. During this period many lines of fruit always have an easement in demand, with a consequent drop in prices. Growers should bear this in mind, and just send along regular consignments, only increasing supplies when requested to do so by agents.

Showery weather has been experienced in most of the coastal districts, spoiling to some extent the keeping quality of softer fruits, such as strawberries.

Melbourne and Sydney markets have maintained values for most fruits, but green papaws and pines have been unpopular and are extremely hard of sale. It is difficult to understand why growers continue to add handicaps to the development of tropical fruit markets in the South. Queensland practically has a monopoly of tropical fruits which, if developed on the right lines, will be a great acquisition to the State. Too often we see custard apples, papaws, pineapples, and other fruits displayed for sale in Melbourne and Sydney shops in such a condition that no Queenslander would consider them as fit for human consumption. It must be remembered that from May to September the weather in Melbourne, judged on Queensland standards, is cold, and that none of the tropical fruits will ripen naturally during such weather. It is necessary therefore to have the fruit fully matured and nearly ripe before it leaves this State.

Prices on the various markets are as follows:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Nines, to 22s. 6d. per tropical case; eights, 19s. 6d. to 22s. per tropical case; sevens, 18s. to 20s. per tropical case; sixes, 15s. to 19s. 6d. per tropical case; small, 12s. to 17s. per tropical case; bunch fruit, 3d. to 9d. per dozen.

Lady's Fingers, 2d. to 7½d. per dozen.

Sydney.—Cavendish: Nines and eights, 22s. to 26s. per tropical case; sevens, 20s. to 24s. per tropical case; sixes, 17s. to 22s. per tropical case. Inferior grades lower in price.

Lady's Fingers (in clusters), to 22s. per case.

Melbourne.—Cavendish: Nines and eights, 23s. to 24s. per tropical case; sevens, 21s. to 22s. per tropical case; sixes, 19s. to 20s. per tropical case.

Pineapples.

Brisbane.—Smooths, 4s. 6d. to 7s. per case; 1s. 6d. to 6s. per dozen. Ripleys, 4s. to 6s. per case; 1s. to 4s. per dozen.

Sydney.—Smooths, 8s. to 11s. per case.

Melbourne.—Smooths, 8s. to 11s. per case.

Papaws.

Brisbane.—Yarwun, 6s. to 10s. per tropical case; Gunalda, 5s. to 6s. per bushel case; Locals, 2s. 6d. to 5s. per bushel case.

Sydney.—12s. to 16s. per tropical case. Green fruit unsaleable and not wanted.

Melbourne.—14s. to 16s. per tropical case. Green fruit unsaleable.

Custard Apples.

Brisbane.—4s. 6d. to 6s. per half-bushel. Supplies of this fruit are now falling off, and prices should remain firm.

CITRUS FRUITS.

Oranges.

Brisbane.—Commons, 5s. to 8s. per bushel; navels (mostly New South Wales), 8s. to 10s. per bushel.

With increased supplies from New South Wales the market for oranges has shown a tendency to ease.

Mandarins.

Brisbane.—Glens, 6s. to 13s. per bushel; Gayndah Glens, 12s. to 14s. per bushel; Emperors, 6s. to 12s. per bushel; Scarlets, 6s. to 12s. per bushel.

Many poor lines of Glens have been marketed, the fruit being past its prime and showing a tendency to dryness. Some small lines of Ellendales have been sent from Gayndah; the fruit was of excellent quality and realised up to 18s. per case.

Sydney.—3s. to 7s. per bushel.

Melbourne.—5s. to 12s. per bushel.

Grape Fruit.

Brisbane.—6s. to 9s. per bushel; specials higher.

Sydney.—4s. to 10s. per bushel.

Melbourne.—4s. to 10s. per bushel.

Lemons.

Brisbane.—Gayndah, 11s. to 14s. per bushel; Benyenda, 13s. to 15s. per bushel; locals, 5s. to 9s. per bushel; southern, 5s. to 9s. per bushel.

Sydney.—2s. to 5s. per bushel.

Melbourne.—4s. to 9s. per bushel.

OTHER FRUITS.

Passion Fruit.

A strong demand exists for lines of first-class fruit. Many growers still make the mistake of packing together smooth and crinkled fruit.

Brisbane.—First grade, 8s. to 10s. per half-bushel; seconds, 5s. to 7s. per half-bushel; specials higher.

Sydney.—4s. to 10s. per half-bushel

Melbourne.—2s. to 6s. per half-bushel; a few specials higher.

Strawberries.

Brisbane.—4s. 6d. to 9s. per dozen boxes.

Sydney.—3s. to 5s. per tray; 7s. to 11s. per dozen boxes.

Berries are not keeping as well as usual, and growers are strongly advised to exercise every care when packing to eliminate any damaged fruit.

Cape Gooseberries.

Brisbane.—6d. to 7d. per lb.

Many lines show a high percentage of green fruit mixed with the coloured. This can be avoided, and the value of the fruit will be raised accordingly.

Tomatoes.

Brisbane.—A sharp rise in the price of tomatoes occurred at the beginning of the month, up to 7s. per case being paid. Prices eased slightly after this, but remained firm at from 4s. to 6s. for really good fruit. Before going to press a further rise had taken place. Prices were:—Green fruit, 2s. 6d. to 6s. per half-bushel; ripe fruit, 2s. 6d. to 6s. per half-bushel; coloured, 3s. to 8s. per half-bushel.

Sydney.—Queensland fruit 4s. to 7s. per half-bushel. Western Australian fruit is expected shortly; so there is a possibility of prices easing slightly, although good fruit will maintain its value.

Melbourne.—Adelaide hothouse, 7s. to 10s.; Western Australian, 4s. to 8s. Large consignments of Western Australian fruit are expected.

Apples.

Brisbane.—Southern fruit: Jonathan, 6s. to 9s. per case; much inferior fruit is on the market, and is hard of sale at from 3s. to 5s. per case; Granny Smith, 5s. to 9s.; Sturmer, 4s. to 6s.; French Crab, 5s. to 6s.; Democrat, 6s. to 7s. 6d.; Rome Beauty, 6s. to 8s.; Yappeen, 7s. to 8s.

Many poor lines of fruit are to be seen on the Brisbane market at present, causing a general reduction in prices. The weather is now beginning to warm up; so Southern growers should take care to send only suitable varieties to this market.

Pears.

Brisbane.—Coles, 9s. to 11s. per case; Nelis, 7s. to 12s. per case: Josephine, 9s. to 13s. per case.

Occasionally consignments of pears arrive unwrapped. These lines inevitably open up specky. All pears for this market must be wrapped in order to arrive in good order.

VEGETABLES.

Cucumbers.

Sydney.—8s. to 12s. per bushel.

Carrots.

Sydney.—6s. to 8s. per cwt.

Beans.

Brisbane.—11s. to 15s. per sugar-bag.

Peas.

Brisbane.—7s. to 10s. per sugar-bag.

Lettuce.

Brisbane.—6d. to 1s. 6d. per dozen.

PUBLICATIONS.

A pamphlet on the marketing of strawberries is now available for distribution. "Harvesting and Packing Peaches and Nectarines" may also be obtained, together with a packing chart.

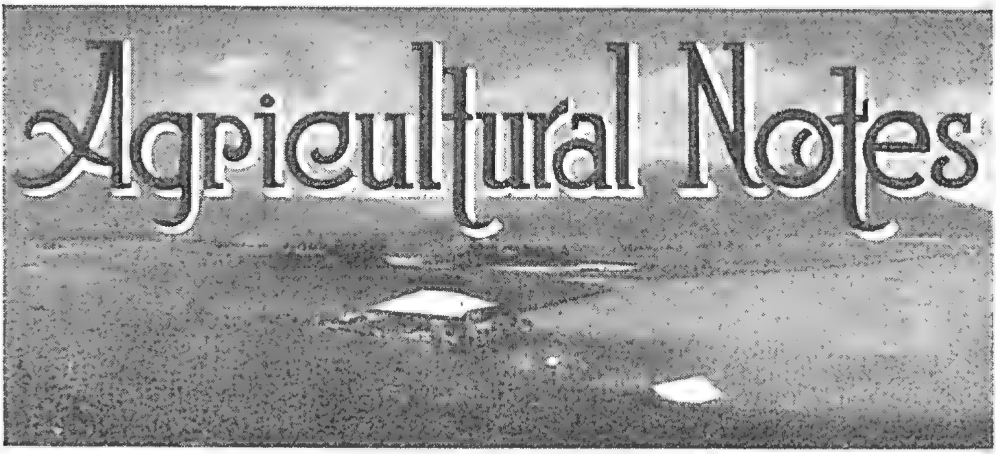
Plate 137.
A Peach Orchard, Bapaume, Stanthorpe District, Southern Queensland.

Plate 138.
Blossom Time in the Peach Orchard.

Plate 139.
Peaches ready to pick.

Plate [illegible]

In the Peach Growing Country, on the road to Glen Niven, near Stanthorpe.



SUITABLE COTTON VARIETIES FOR THE 1937-38 PLANTING.

R. W. PETERS, Acting Director of Cotton Culture.

The bulk of the requirements of the Australian spinners for the coming season will be for cottons of $\frac{15}{16}$ to $1\frac{1}{16}$ inches in length. This will necessitate a greater growth of varieties producing these staple lengths than has been the custom in the past. The following recommendations therefore are made to assist farmers who have not grown such cottons before in selecting the most suitable variety of this type for their soils.

The best variety producing the shorter cottons on the alluvial soils of fair to good fertility in the Southern district and the South and Central Burnett districts appears to be the Half and Half, which has yielded very well in these areas during the last two seasons. It has not done well in trials in the Callide Valley, and cannot be recommended for that area. It has a medium-sized boll, which picks well when the variety is grown under favourable conditions, yields cotton around $\frac{15}{16}$ inches in length, and has a lint percentage of approximately 40. It should not be grown on soils of low moisture retaining ability, for adverse conditions markedly reduce the size of the bolls and the quality of the lint.

The Lone Star variety appears to be the outstanding cotton for most of the clay loam soils of the lower slopes originally covered with ironbark and box trees of the forest series; and brigalow, brigalow-wilga, and brigalow-belah of the scrub series. For several seasons this variety has yielded satisfactory returns on such soils in the Maranoa, the South, Central, and Upper Burnett, and the Callide Valley districts. It is rather a vigorous grower on fertile loamy soil, however, and therefore should not be planted on alluvial loams in districts likely to experience heavy mid-seasonal rains. It has large, well opened, easily picked bolls, produces fibre from $\frac{15}{16}$ to $1\frac{1}{16}$ inches in length, according to soil and climatic conditions, and yields around 36 per cent. lint for the bulk stocks, and up to 38 in some of the newer developed strains. It is undoubtedly a variety well suited for many of the districts, and should be grown wherever possible, as the lint is in great demand by the spinners.

Another big-bolled cotton that should be grown to the fullest extent is the Miller variety, which has given excellent results on the clay loam soils of the lower forest and scrub slopes, as well as on the alluvial clays of moderate fertility in the Wowan, Callide Valley, Upper Burnett, South Burnett, and Southern districts. It is earlier fruiting than Lone Star and can, therefore, be planted on more fertile soil, but requires greater moisture than does the latter variety, thus making it a better cotton for the heavier soils of the slopes in the coastal areas. The bolls are very large, and are picked with exceptional ease, particularly on cultivations following grassland; the fibre is the fullest bodied of any cotton grown here, and averages around an inch in length, with a 35 lint percentage. As a rule rather high grades of lint are obtained with Miller, for the fibres clean up well in the ginning operations.

Cliett is a big-boll variety that competes with Lone Star and Miller under certain specialised conditions, but is not recommended for distribution except where carefully conducted tests have indicated its superiority.

Mebane is a nice type of big-boll cotton that produces excellent fibre on sandy soils overlying clay in the drier districts and on the harder clay melon-hole soil types of the brigalow scrub, where it gives very satisfactory results. It is not suited to the better soil types, however, owing to a tendency to make rank growth on such soils under good rainfall. Under suitable conditions it is a good picker, with a 38 lint percentage, and produces fibre ranging from 1 to 1 $\frac{1}{16}$ inches in length.

The most promising of the shorter cottons for the fertile alluvial loams in the Upper Burnett, Callide Valley, and Wowan districts appears to be the Ferguson variety, which has yielded well in varietal tests, and many of the commercial trials during the last two seasons. It is a relatively new variety, but appears to have distinct possibilities of supplanting the Durango, Starvale, and Indio Acala varieties in these areas, particularly if it is grown on new or grassland cultivations. It produces a nice style of $\frac{15}{16}$ to 1-inch cotton, has a 37 lint percentage, and a boll of medium size which opens and picks well.

It also will be necessary to produce a reasonable amount of 1⅛-inch cotton, and farmers who have obtained satisfactory yields of high-grade cotton with Durango and Indio Acala should continue to grow these varieties. It is advised, however, that there is little market for the softer or yellow-spotted grades of these longer cottons, and where growers have received mostly yellow-spotted grades they should try either Miller or Ferguson, for apparently their conditions are not suitable for the longer cottons. It is stressed though, that there is a bigger factor of safety for obtaining satisfactory yields of cotton of good quality from all varieties, during the first three or four seasons following the breaking up of grassland. After that, the changes in the chemical and physical condition of the soil that occur with further cotton cultivation make it necessary that the varieties be selected very carefully to suit the soil and climatic conditions.

It is strongly recommended that when in doubt as to the best variety, the farmer should apply for advice either to the field officer of the cotton section of the Department of Agriculture, stationed in his district, or direct to the Department of Agriculture and Stock, Brisbane, for a large amount of evidence has been collected as to the merits of the different varieties which would be of assistance in determining the best variety, if the soil type is described.

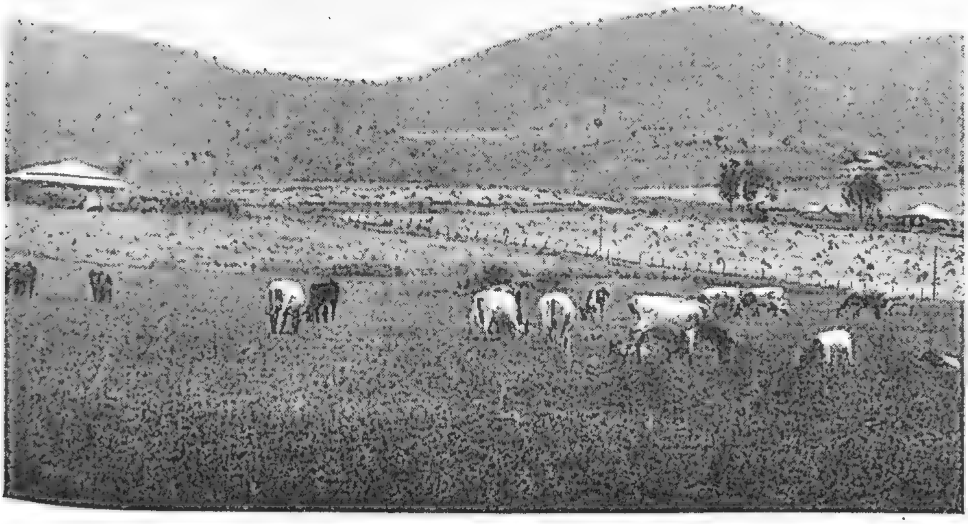


Plate 141.
Crop and Pasture Land near Killarney, South Queensland.

MILLETS IN CENTRAL QUEENSLAND.

W. R. STRAUGHAN, Instructor in Agriculture.

Owing to the absence of winter rains many dairy farmers have areas of cultivated land under fallow which they were unable to plant with winter cereals, and now that the period for the planting of such crops is past some alternative summer growing feed undoubtedly is needed. The quickest growing fodder crops are the millets. Since the preparation of the land for winter cereals has been shallower, probably, than that necessary for maize and sorghums, millets should give the most profitable returns.

The millets—Japanese, white panicum, and giant setaria or giant panicum—are hardy plants and stand dry conditions well. They are quick growing, and have supplied material for grazing within six weeks of planting. These plants, however, should not be grazed before the roots are sufficiently strong to avoid their being pulled up by stock; and where judiciously grazed under favourable weather conditions, a good ratoon crop may be expected of them.

Where the green feed is not required, millets make a good quality hay if cut when the seed heads are formed and before the seed has developed. A delay in cutting occasions loss in several ways, and it is better, if there is any doubt as to when the crop is to be cut, to err on the side of greenness rather than otherwise. If cut too green the hay may cause a slight scouring of stock; but if it is too well matured a loss of digestible plant nutrients will result. Further, if such a free-seeding crop is allowed to mature the scattered grain will cause trouble in subsequent crops by the resultant volunteer growth, and the seed, if carried into the haystack or shed, provides food for mice.

Quite frequently, with a desire to attain balance in their stock foods, farmers have sown cowpeas with the millets very successfully, thus increasing the protein content of their fodder and so improving their cream returns.

Millets, also, especially in combination with coarse-stalked crops—such as maize and sorghum—make excellent silage, and since they produce 10 to 12 tons of green material to the acre under good conditions they may be used most advantageously for that purpose.

Millets prefer a loam for maximum growth, but will grow on a wide range of soils; even poor lands, if sufficient moisture is present, will give payable yields. Early sowings can be made as soon as frosts are over and can be continued successfully until January and February. Only small areas should be planted in November and December to provide grazing, as the heavy summer rains in January are apt to prevent the harvesting of any surplus as hay.

For sowing 10 to 12 lb. of seed per acre are usually sufficient when broadcast and harrowed in. When sown for hay, or on rich soils, a heavier seeding (about 15 lb.) is frequently used with a view to producing a fine-stemmed crop. Too heavy a seeding (over 20 lb.), however, will not have this effect, since—especially during a short dry spell—the original stand is quickly reduced by competition sometimes even to meagre proportions.

Of the varieties white panicum is undoubtedly the most popular. A quick grower, it stools well and reaches a height of from 4 to 6 feet. It has a flat stem and makes a good bright hay of some commercial value. Japanese millet is slightly shorter in its mature growth, but is—especially in the earlier stages—an even quicker grower and heavier stooler than white panicum, and is most suitable for grazing. Giant setaria (or giant panicum) has also received some attention, and under favourable conditions good results are obtained. Under adverse conditions, however, it does not appear to give as good results as the other varieties.

The millets are also very useful in controlling summer weed growth, but, of course, should be taken out before the time arrives to begin preparing the land for autumn planting.

THE SACCHARINE SORGHUMS.

N. A. R. POLLOCK, Senior Instructor in Agriculture.

The saccharine or sweet sorghums provide a great bulk of nutritious fodder palatable to all classes of stock, and their general hardiness should commend them to all farmers seeking a sustained supply of stock food. They may be grown successfully throughout the State, and, while maize is popularly considered to be more nutritious, the difference of food unit values is very small and more than outweighed by the increased quantity of fodder usually produced by the sorghums.

Maize quickly deteriorates on reaching maturity or under dry weather conditions. The sorghums, however, are more retentive of their succulence. Even after frost the stems retain their characteristic sweetness, and this, especially when the crop has been planted in February or early March, ensures a supply of succulent feed for the early winter months. They will grow in a great range of soils, and, although slower of germination than maize and consequently more difficult to keep clean in the early stages of growth, will withstand even prolonged dry periods when established, and following such periods will make quick response to any favourable weather changes.

As a silage crop they are second in value only to maize, and under dry conditions their added succulence makes them even preferable. Sorghums, like other crops, make their maximum growth only when the land has been thoroughly prepared. When the food supplies require to be augmented rapidly planting on incompletely prepared soil may be excusable, but generally speaking that procedure is not regarded as good farming.

Sowings may be made either broadcast, when 10 to 12 lb. of seed per acre will be required, or in drills at the rate of 4 to 6 lb. of seed, according to the quality of the soil and the fineness of stem desired. Planting in drills is preferable, for although it is frequently claimed that broadcast crops have the advantage of being finer stemmed they are usually shorter of stature, and the average yield is generally lighter and harvesting more difficult. Sowing in drills allows of inter-row cultivation —a distinct advantage. Cultivation should be regular enough to check weed growth, and thus conserve moisture, and should be progressively shallower to avoid root damage. A maize drill fitted with sorghum plates is quite suitable for sowing. A wheat drill, with appropriate outlets blocked, is also quite convenient. Failing a seeding machine the drills usually are opened by a plough or scuffler and the seed is dropped by hand and covered by the harrows.

The crop should be harvested when the seed has formed, and is commencing to harden, usually three to three and a-half months after sowing. In small areas harvesting is usually done by hand with a cane knife. In large acreages such a method is too slow and laborious and if a maize binder is not available, a sledge cutter will be found most convenient. Such a cutter can be made on the farm, and particulars regarding it are obtainable from the Department of Agriculture and Stock. It can be drawn by one horse. Light crops may be cut with a mower or harvested with a reaper and binder.

Stock should not be allowed access to the sorghums during the first few weeks of growth, or after a check due to dry weather. They can be fed safely when mature, or even earlier, provided that the fodder is allowed to wilt for a day or so after it has been cut. The risk of poisoning can be minimised by feeding molasses with the fodder.

Saccaline undoubtedly is the most favoured variety. Good crops attain a height of 10 to 12 feet and the stem is only moderately coarse. It is the most frost-resistant of the varieties under general cultivation, is sweet flavoured, and the seed is easily procured. White African is a very quick-growing variety in its early stages; but it is later in maturing. The stem tends to coarseness. It, however, is a very heavy yielder, although not quite so succulent as saccaline. It stands frost well.

Imphee or Planter's Friend is very similar to saccaline—though generally not so vigorous a grower.

Honey, an American importation, grows to a height of over 12 feet. The stem is thick, but it is particularly well supplied with juice of a characteristic sweetness. Some exceptionally heavy crops of this variety have been obtained, but seed is difficult to procure and the crop does not resist frost well.

Other varieties include Early Amber, a fine pithy-stemmed, early maturing variety which has gone out of favour; Collier, a fairly fine-stemmed variety yielding well; and Cowper, a moderately early crop, giving very useful yields.

COWS ARE QUIETER WHEN DE-HORNED.

When properly and humanely done, the after effects of de-horning is scarcely noticeable in dairy cows. For a few days they may give a little less milk, but after that they quickly return to full production. They are quieter in the yard and no longer are in continual terror of attack from bullies at milking time. Contentment leads naturally to improved production.

Brisbane Exhibition, 1937.

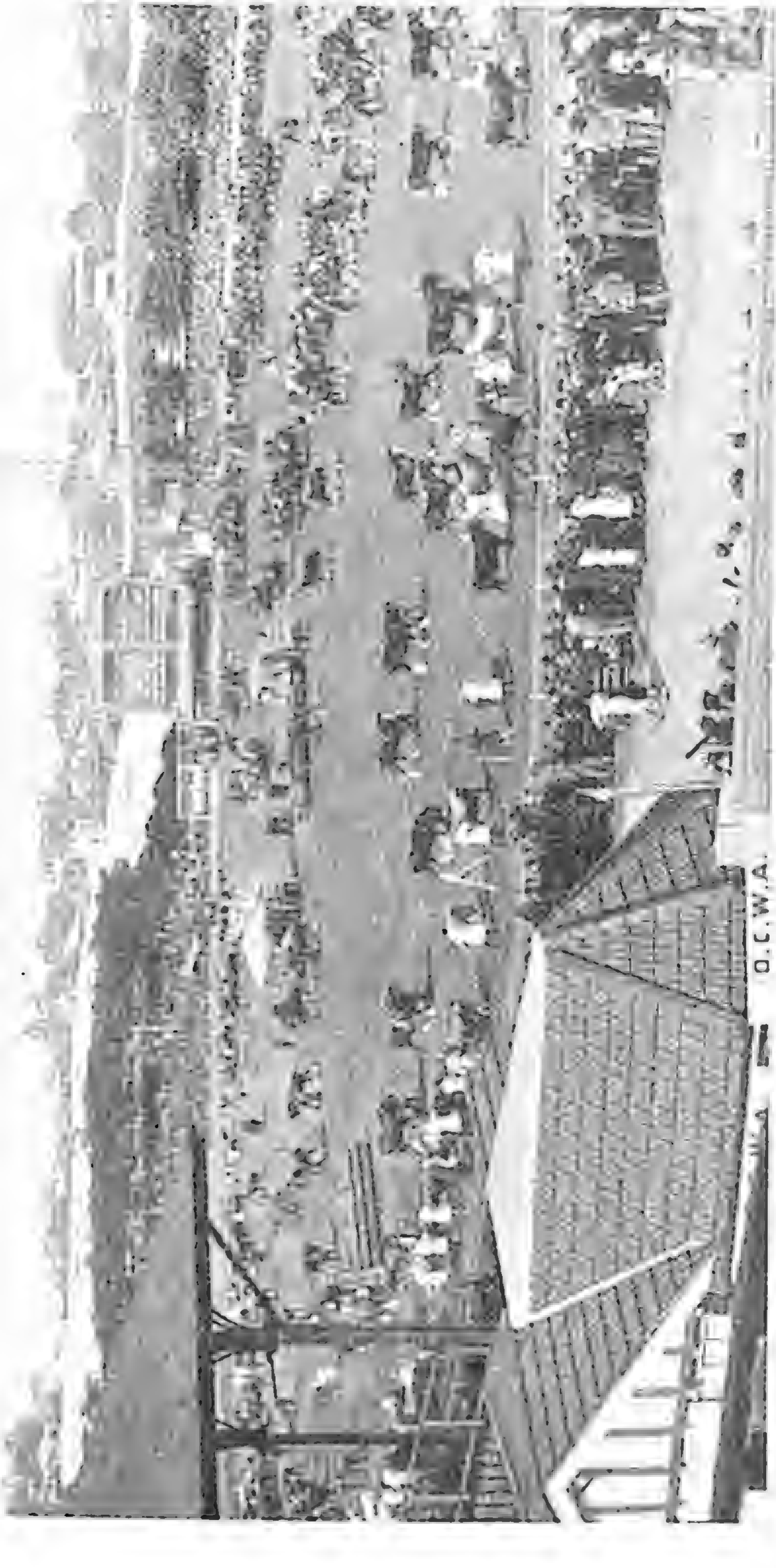


Plate 142.

THE SHOW STOCK MUSTER FOR THE GRAND PARADE.—The Brisbane Exhibition provides one of the finest stock shows in the Commonwealth. Many of the leading families of the British breeds of cattle and horses—some from famous stud establishments in the United Kingdom—were represented worthily in the ring. The daily parade of the aristocrats of Queensland herds around the arena was among the most popular events of the Show.

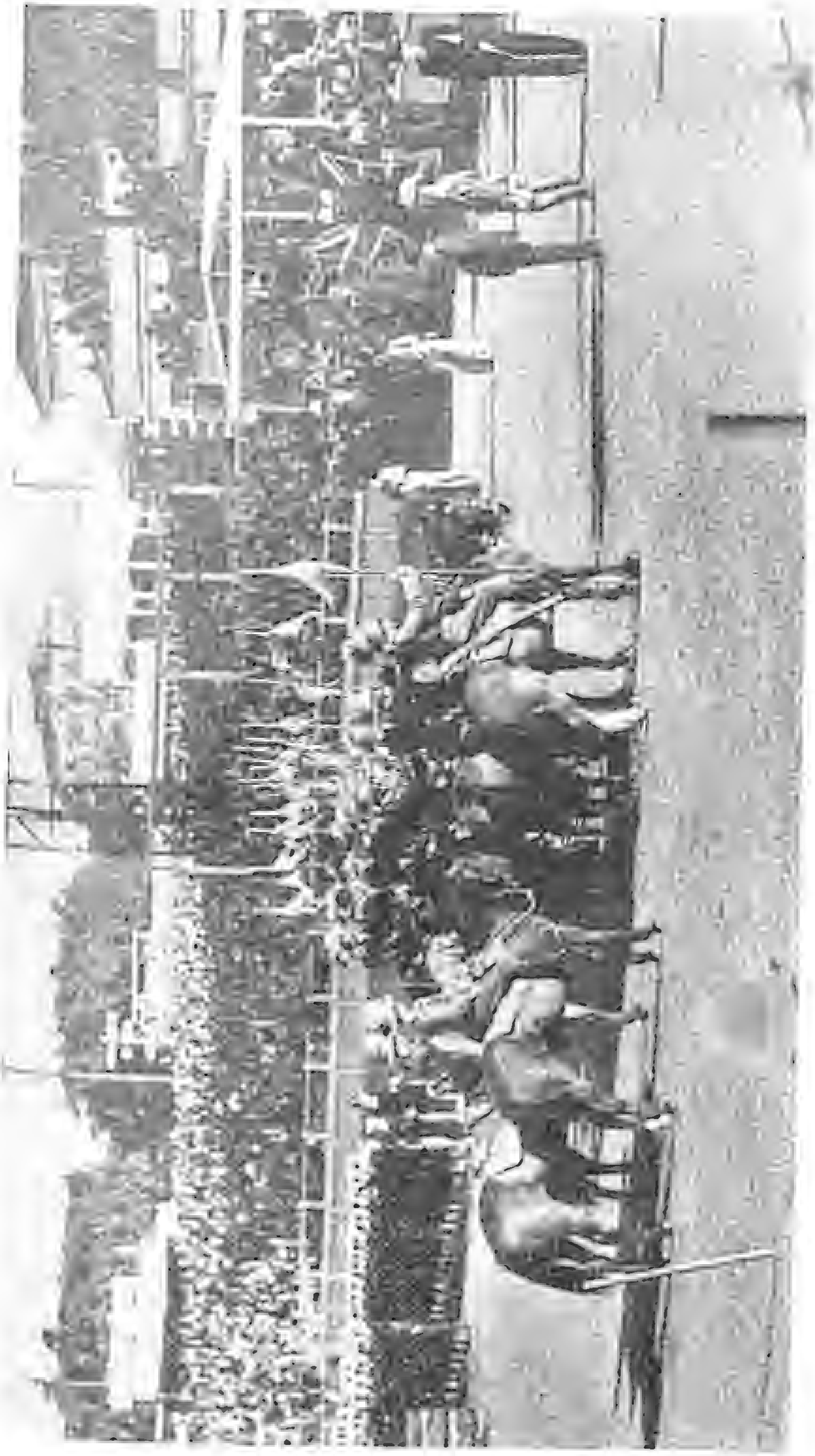


Plate 143.

THE OPENING CEREMONY AT THE BRISBANE SHOW.—His Excellency the Governor-General, Lord Gowrie, V.C., P.C., G.C.M.G., D.S.O., inspecting his Cavalry Escort and Naval Guard of Honour.

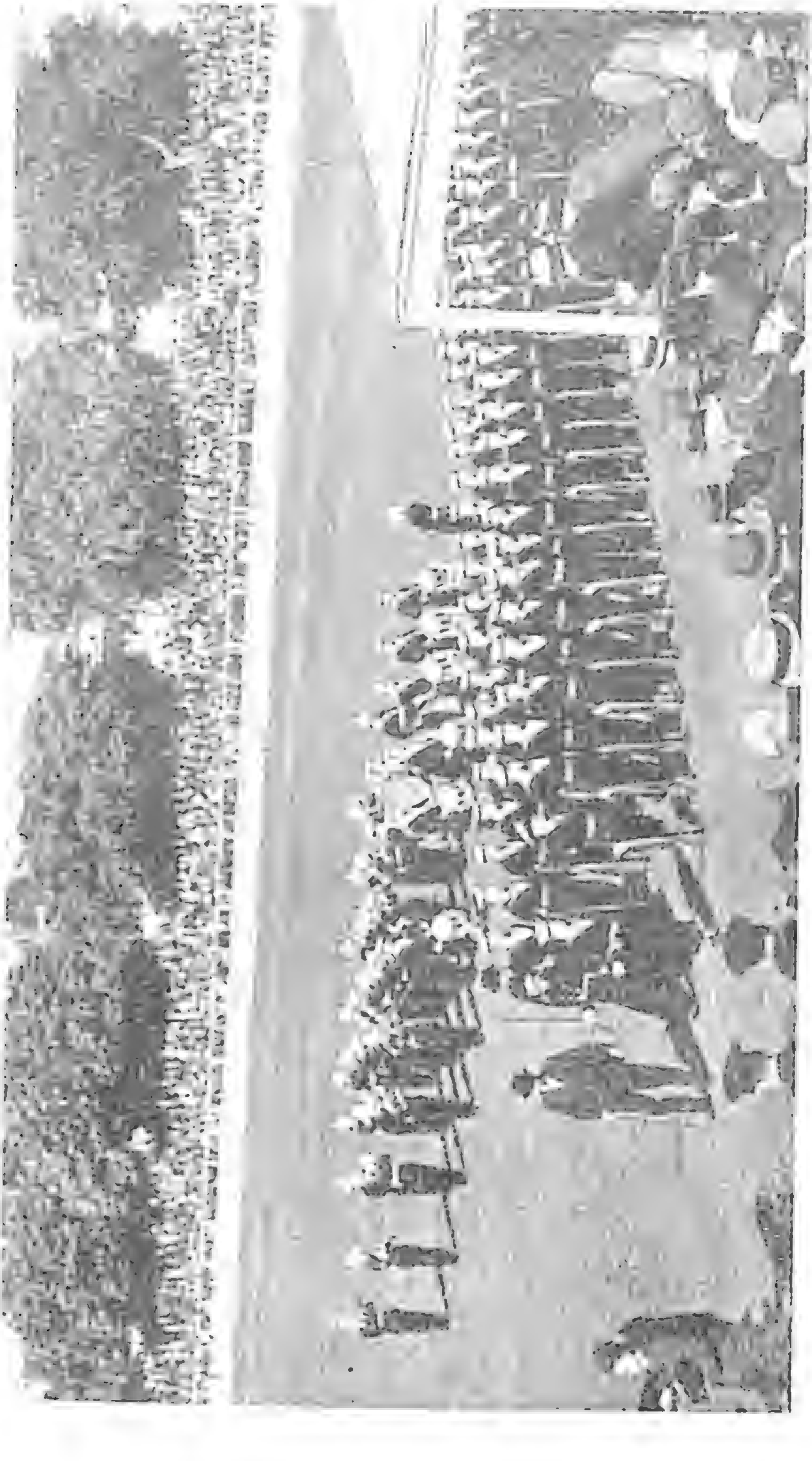


Plate 144.

The Governor General's Naval Guard of Honour from the Royal Australian Navy at the Opening of the Royal National Show, Brisbane, on 18th August.

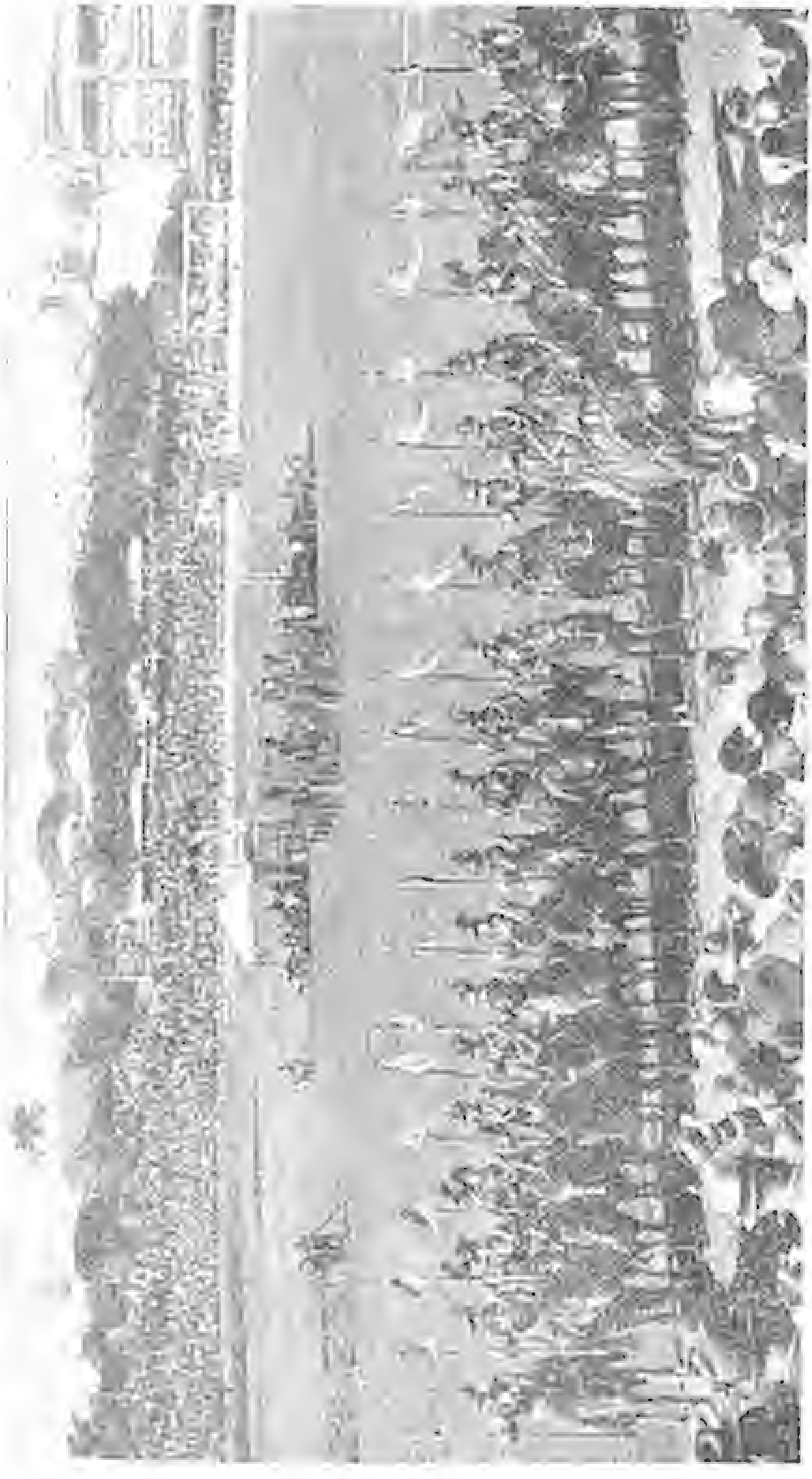


Plate 145.

The Governor-General's Cavalry Escort.—This troop of Australian Light Horse (Volunteer Militia) consisted of men from the country who are engaged actively in rural industry.

Plate 116.

The Wealth of Queensland's Great Grain Region.—The central feature in the Court of the Department of Agriculture and Stock was evidence of the plant breeders success in evolving wheats suitable to Queensland conditions of summer rainfall. It illustrated also the progress made in maize production and the propagation of new varieties.

The whole lay-out of the Court was a credit to the designer, Mr. Stanley Burchill, of the Agricultural Branch.

Plate 147.

PRODUCTS OF A FRUITFUL COUNTRY.—Excellent specimens of the numerous temperate and tropical fruits grown commercially in Queensland were included in this impressive display of the Fruit Branch. Working models of various mechanical contrivances used in the orchard and packing shed added to the interest of a great exhibit.

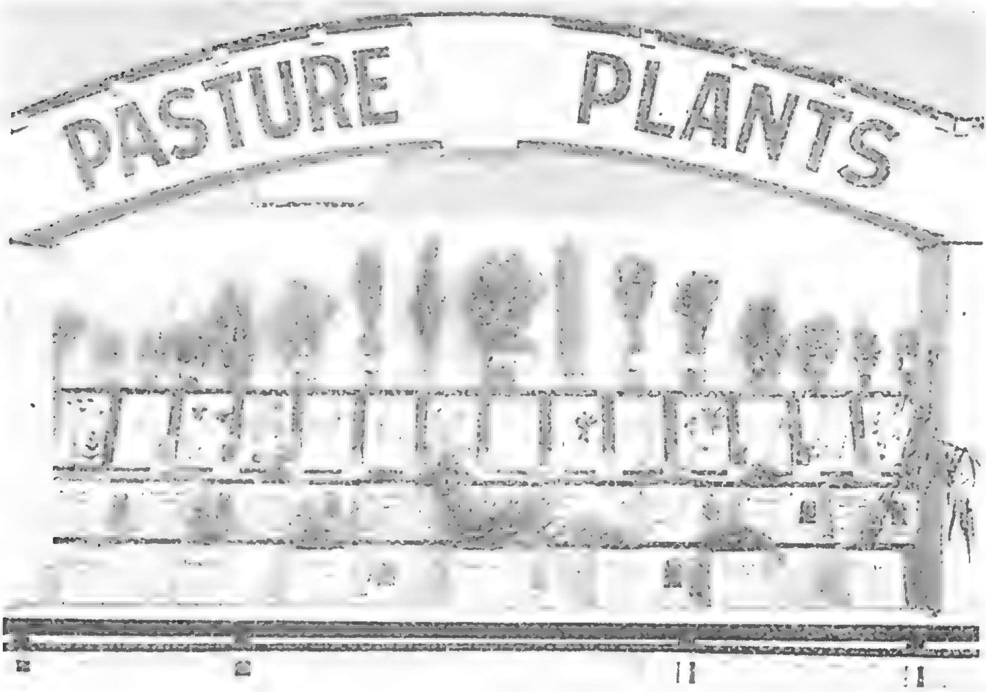


Plate 148.

"ALL FLESH IS GRASS."—A striking panel of pasture grasses emphasised the truth of the Scriptural dictum. Probably 80 per cent. of Queensland's wealth is derived from nutritious indigenous and introduced grasses.

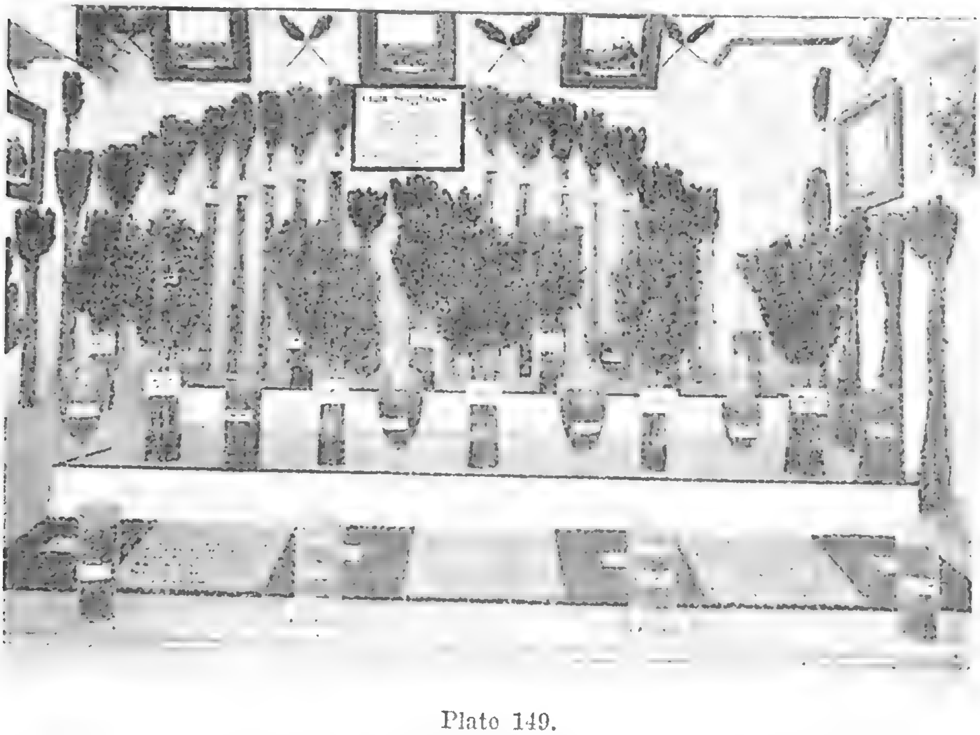


Plate 149.

A DISPLAY OF GRAIN SORGHUMS.—In Queensland a considerable area is sown annually with sweet or feed types, which are valued as fodder and silage—suitable varieties being Saccaline, White African, and Imphee. The grain types are not grown to a similar extent, but in view of their capacity to yield heavy crops of nutritious grain under severe climatic adversity, which would be fatal to successful maize production, it is considered that a larger area could be cultivated for grain. An alternative feed grain produced economically would be welcomed by the pig and poultry industries.

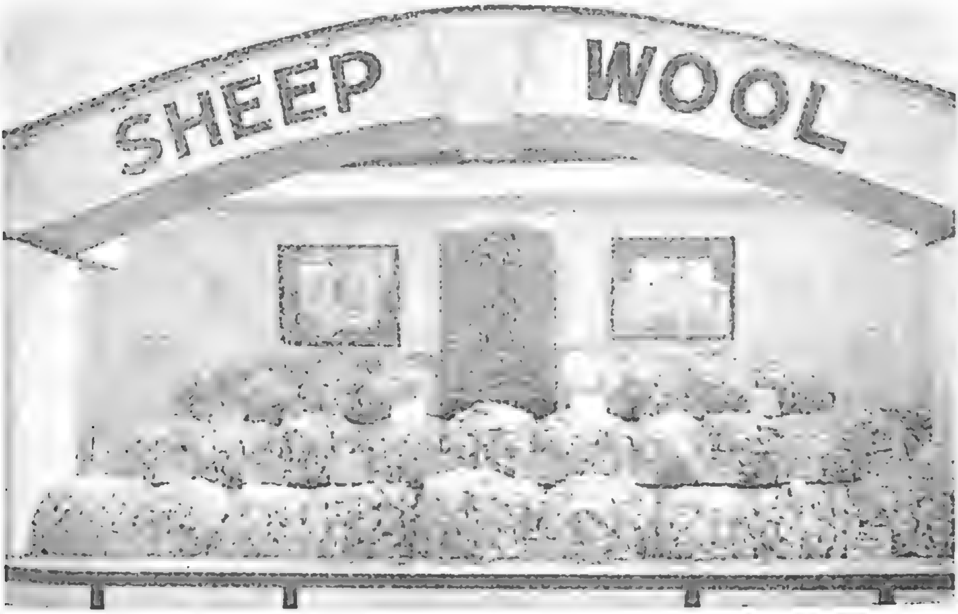


Plate 150.
Queensland's Wealth in Fine Merino Fleeces.

Plate 151.
Queensland Lint for Australian Looms.—High spinning quality is a characteristic of Queensland fibre. The Cotton Alcove contained impressive evidence of the importance of a new and staple industry.

Plate 152.

PRODUCE FROM ST. LUCIA FARM SCHOOL.—A corner of the Court of the Department of Agriculture and Stock in which was displayed samples of crops produced by city boys undergoing training for a country career. A free six months' practical training course for youths and young men is available at St. Lucia. A thorough grounding in the rudiments of every branch of farm work is given amid beautiful rural surroundings on fertile land fronting a reach of the Brisbane River. At the end of the course a farm job for every trainee is guaranteed. Farmers' demand for St. Lucia trainees is far in excess of the number of boys available. This fact is a further demonstration of the practical value of the training that the Farm Training School provides.

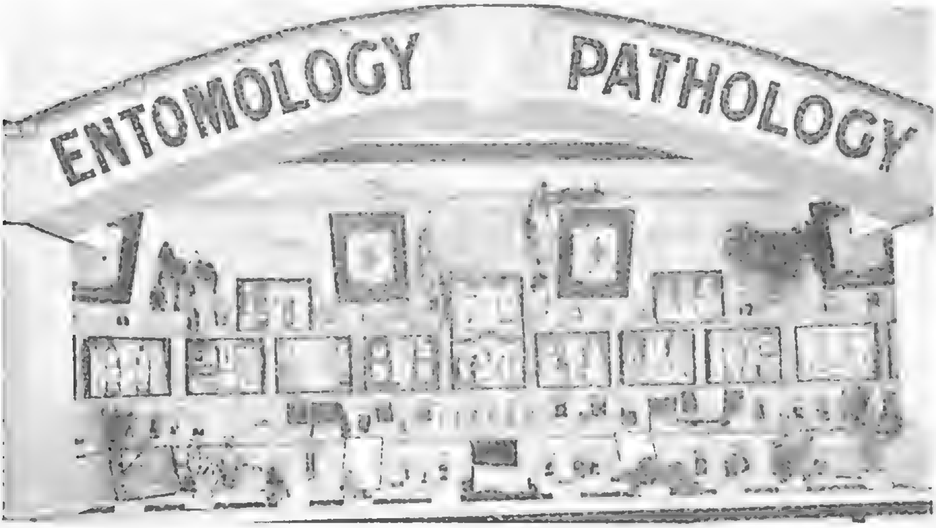


Plate 153.

Science Serves the Farmer.—The place of Economic Entomology and Vegetable Pathology in Rural Economy was shown in a striking way by this well-arranged display.

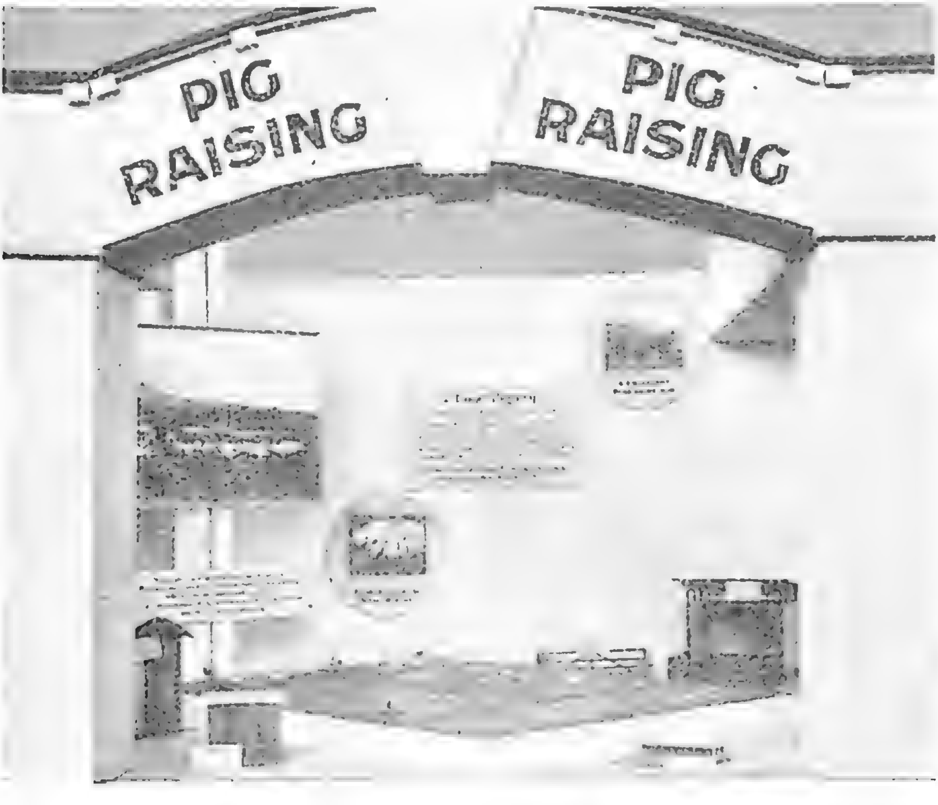


Plate 154.

A Model Pig Farm.—Complete in every outdoor detail, in an alcove of the Departmental Court was a centre of popular interest. Pig raising is a firmly-established and rapidly-expanding industry in Queensland. An export trade in frozen and chilled pork has developed remarkably in recent times. Throughout the year an active educational campaign on carried on, and this display illustrated the effectiveness of that work.

Plate 155.

A MODEL POULTRY FARM was the central feature of this interesting exhibit. The poultry industry in Queensland is now approaching £1,000,000 in annual value.

Plate 156.

"A DISEASED ANIMAL IS A LIABILITY."—Some of the activities of the Animal Health Station at Yeerongpilly were illustrated impressively and effectively in this corner of the Agricultural Court.

Plate 157.

THE JOURNAL ALCOVE IN THE DEPARTMENTAL COURT.—A rendezvous for visitors from the agricultural districts of the State, both far and near. Arthur F. Crees and Tom Stevenson are the young officers in charge. Other officers associated with the several divisions of the Department of Agriculture and Stock were in attendance to advise show visitors on matters connected with the exhibits and the laboratory and field work of the Department generally.

Plate 158.

TO GO UP IN SMOKE.—The high standard of quality of Queensland leaf for pipe, cigar, or cigarette was well exemplified in this array of exhibits representative of every tobacco-producing district in the State.

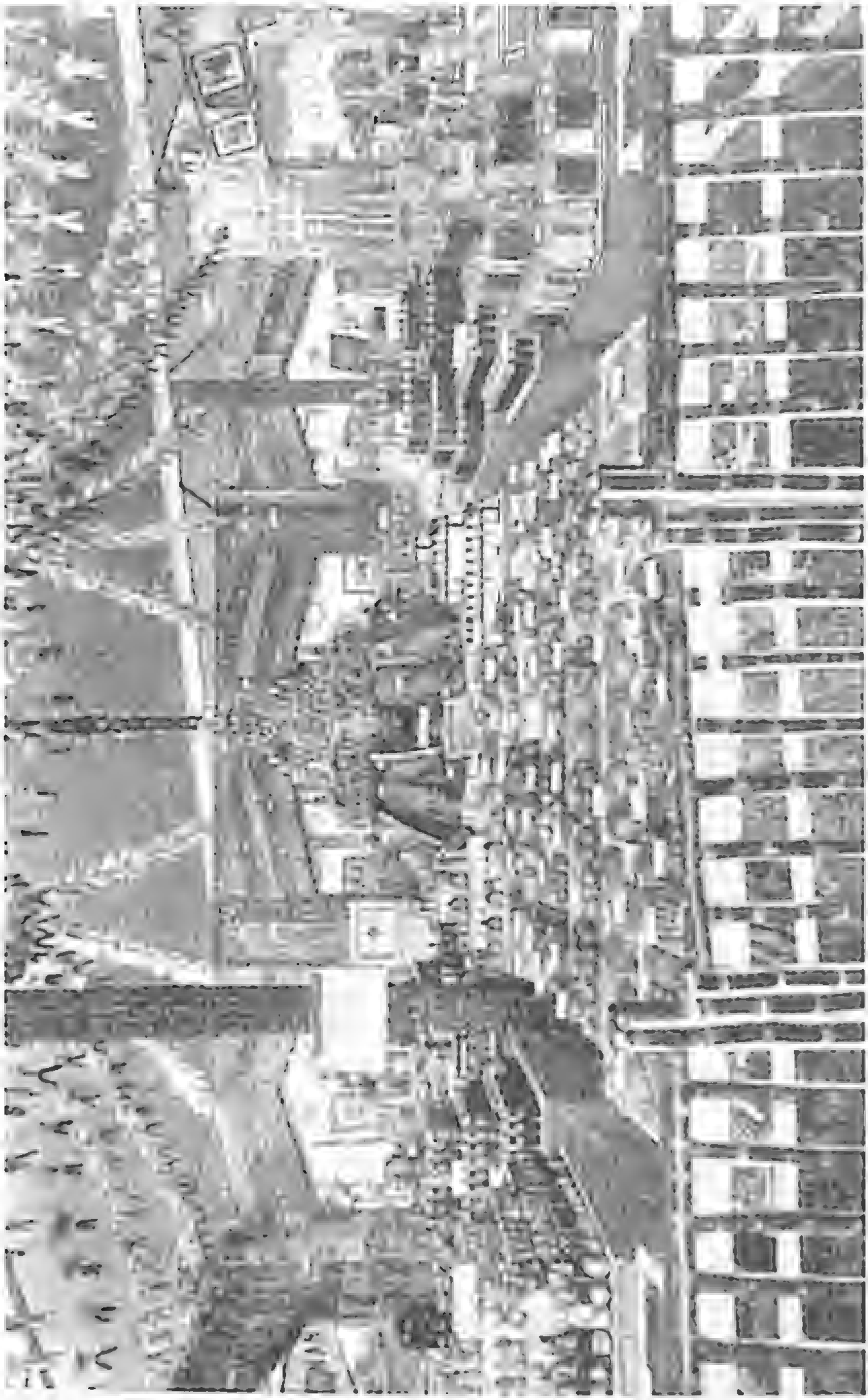


Plate 159.

WEST MORETON WINS AGAIN.—Pillars and arches of sugar cane, blending in well-toned tints, were included in the decorative features of the A Grade District Exhibit, to which was awarded the place of honour. Pastoral, agricultural, mineral, and industrial products from one of Queensland's most progressive provinces were assembled in one comprehensive display.

Plate 160.

THE AGRICULTURAL AND MINERAL WEALTH OF THE CENTRAL BURNETT.—Pillared, panelled and palisaded with multi-coloured sugar cane, and replete with the products—all of a high standard of excellence—of the field, factory and farm home, this exhibit from the Gayndah district was a striking representation of the industry and the richness of natural resources that made it possible.

Plate 161.

THE WEALTH OF WOOMBYE FRUIT LANDS.—This fine display of temperate and tropical fruits typified the wide range of horticulture practised successfully on the near North Coast.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of July, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter. Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS				
SENIOR, 3 YEARS (OVER 3½ YEARS), STANDARD 290 LB.				
Model VI. of Alfa Vale (365 days)	W. H. Thompson, Alfa Vale, Nanango	14,251·1	592·462	Reward of Fairfield
JUNIOR, 3 YEARS (UNDER 3½ YEARS), STANDARD 270 LB.				
Laguna Venus II.	F. G. Lamkin, Moola, Dalby	8,759·45	344·819	Morden Marcus
Glenore Ginger (272 days)	A. M. Johnson, Gracemere	7,204·95	274·771	Sunnyview Union Jack
SENIOR, 2 YEARS (OVER 2½ YEARS), STANDARD 250 LB.				
Glenore Heiress	A. M. Johnson, Gracemere	8,052·45	295·263	Sunnyview Union Jack
Blyth Alpha 1st	A. M. Johnson, Gracemere	7,571·6	278·413	Blacklands Headlight
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Rosenthal Milkmaid 10th	M. C. and A. M. Sullivan, Pittsworth	7,004·23	275·65	Rosenthal Carbine
JERSEY.				
JUNIOR, 4 YEARS (UNDER 4½ YEARS), STANDARD 310 LB.				
Pineview Clementine	F. Maurer, Darra	6,383·6	362·1	Buttercups Noble
JUNIOR, 2 YEARS (UNDER 2½ YEARS), STANDARD 230 LB.				
Retford's Hope of Hamilton	J. Wilton, Raceview	7,652·25	461·269	Retford May's Victor
Woodlands Fashion	D. R. Hutton, Cunningham	5,741·75	294·932	Kenmore Victor
Bellgarth Viola II.	D. R. Hutton, Cunningham	5,184·	282·961	Trecarne Renown II.
Carnation Princess Victoria	D. R. Hutton, Cunningham	4,634·77	241·714	Vincheles Golden Victory

The Tropics and Man

WATER AND SALT.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology, University of Queensland.

Second Series: No. 2.

IN the last article we saw that the skin blood-vessels dilate under hot conditions, and it sometimes happens that there is not enough blood to fill the blood-vessels, with a consequent bad effect upon the working of the different parts of the body. This condition is made worse, of course, if the amount of blood is reduced at the same time. Such a reduction must occur if the body is losing more water than it is taking in.

"Most Important Factor."

About 65 per cent. of the body is water. Man sometimes can stand a reduction to 45 per cent., but beyond this death will occur. The supply of water is a much more important factor than the supply of food in the early days of a period of privation. This was demonstrated clearly in the recent air disaster on the Lamington Plateau. This insistent demand for water is due to its unique property of dissolving a large number of substances.

Nearly all the intricate and delicate chemical processes upon which life depends are carried out in solution, and if water is taken away they must go wrong or cease altogether. We have seen also that the blood cannot circulate unless enough water is present to allow the blood to fill the vessels and to run freely in the vessels. Blood in men dying from thirst is so thick that it hardly runs from veins when they are cut. A peculiar thing is that even in these people the kidneys go on secreting small quantities of urine and continue to excrete waste products.

Points About Water Drinking.

Water is lost from the body in three ways—from the lungs in the breath, from the skin as insensible perspiration and as sweat, and from the kidneys and alimentary canal in the excreta. Under normal conditions, we drink more water than we require to replace our losses, and the excess is passed out by the kidneys. If the loss of water by one of these channels becomes excessive, as it certainly does during hard work under very hot conditions (2 lb. of sweat an hour), then the ordinary intake is no longer enough. The sensation of thirst is some indication of our need for water, but is not always a reliable guide. It is better to take enough water to prevent thirst occurring than to wait for thirst to sound the warning. The volume of urine may be reduced quite definitely without thirst being noticeable; in fact, this is the usual state of affairs in the tropics. It probably is unwise to allow the reduction in urine to continue day after day, as there is some evidence that the occurrence of "stone" is increased thereby. Another point about water drinking is that it probably is better to take small drinks frequently than large drinks periodically. The taking of a large drink causes a burst of sweating in many people, which, to a certain extent, undoes the good done by the drink. Such sweat, too, runs off the body without evaporating, and is wasted as far as cooling the body is concerned.

Effects of Dehydration.

The first outstanding effect of water deprivation upon the body's working is upon the blood circulation. The volume of blood is reduced and it becomes increasingly more difficult for the body to keep its vessels filled. As a result, all the body tissues are affected, but the nervous system is the first to show these effects. We noticed the symptoms last time—tiredness, irritability, lack of concentration, faintness. Partly through this and partly through lack of sufficient fluids, the working of the digestive system is upset. Loss of appetite, "indigestion," constipation and interference with food absorption occurs. Spices, laxatives, and alcoholic stimulants are frequently indulged in with little lasting effect, when a very simple preventive is to hand—the drinking of sufficient water. That familiar sensation of fatigue in hot weather is due in large part to lack of water. The muscles are dehydrated, their salt balance is disturbed, and the nervous system supplying them is upset for the same reasons. Usually things do not progress much beyond this stage but, even so, this stage occurs far more commonly than it need and takes a large toll in lowered efficiency and predisposition to fatigue. If dehydration progresses, however, the circulation of the blood, impaired by lack of water, often leads to disordered chemical behaviour in all the tissues of the body, so that excessive amounts of acid materials are produced, and these accumulate because the poorly-working kidneys cannot get rid of them. All these things combine in speeding each other up and forcing the body to a crisis.

Salt Loss from the Body.

The importance of salt to the body has been appreciated since the days of the primitive peoples, and its importance to men working on hot jobs was recognised early in this century. The wave of enthusiasm for the newly discovered parasites as the cause of tropical disease, however, tended to obscure its recognition by the large majority of white dwellers in the tropics. It is only recently that its full importance has been realised.

The blood contains 0·6 per cent. of salt. When one starts to sweat profusely through work in a hot atmosphere, the sweat contains only a little salt, say 0·1 per cent., but as the sweating continues, the percentage rises to that of blood. People vary a good deal in the salt content of their sweat, and one thing we are trying to discover is whether this is in any way related to their ability to withstand hot climates, and also the effects of acclimatisation. (I, for instance, have much less salt in my sweat than my London colleagues.)

Men working hard in hot climates lose a great deal of salt. This must be replaced, and in hard workers, this means the addition of a liberal amount of salt to the food.

Effects of Salt Lack.

The first effect of salt lack is the reduction of the amount of salt excreted by the kidneys. This is a protective measure and suffices for short periods. The second effect is the mobilisation of salt from stores in the body. Some people have good stores. (I was unable to exhaust mine even when I lived on a strictly salt-free diet for a week and lost several pounds of sweat each day.) Others have almost none. (The blood salt of one of my subjects fell by one-quarter while sitting in a hot room for six hours.) When these protective measures fail, the blood salt

begins to fall. When it falls about one-third, muscle cramps begin—miner's cramp or stoker's cramp. These may be most violent and excruciatingly painful, and men may die even in an attack. Dramatic relief is obtained by injecting strong salt solution.

Apart from the severe effect of marked reduction in the body's salt content, there are probably many more subtle disturbances associated with a chronic salt deficiency insufficient to produce cramps. It is thought that the failure of sweating sometimes seen in hot dry countries, as a prelude to heat stroke, is due to salt lack. It has recently been discovered that the salt and water content of the body come partly under the control of a ductless gland, known as the adrenal cortex. Extracts from this gland relieve certain cases of neurasthenia. This raises the question as to whether tropical neurasthenia is associated with chronic mild salt lack.

Rules for Prevention.

1. Take *plenty* of fluids in hot weather, especially if doing manual labour.

2. Take frequent small drinks rather than a few large drinks.

3. Use laxatives and appetising spices only with discretion; seek to remedy the cause of the trouble.

4. Add salt plentifully to the food; the body can get rid of excess, but it cannot make up a deficiency.

5. All these rules apply even more forcibly in hot dry climates.

[*Photo: P. P. Comiskey, Stock Branch.*

Plate 162.

CROSSING THE GEORGINA.—The "lead" of a mob of Brunette (North Australia) bullocks, travelling south, crossing one of the channels of the Georgina River, at the "One Mile," near Urandangie, West Queensland.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Prickly Supple Jack.

J.J.S. (Helidon)—

The specimen you sent is *Smilax australis,* commonly known as Prickly Supple Jack. It is a very common plant in Queensland, particularly on hillsides in heavily forested country. It is not known to possess any poisonous qualities.

Grasses and Weeds.

G.H. (Booinbah, via Goomeri)—

1. *Senebiera dedyma,* bitter cress. A very common weed in cultivation in Southern Queensland. It is one of the worst milk-tainting weeds we possess.
2. *Xerotes* sp., mat rush. A book, "The Principles of Botany for Queensland Farmers," shortly to be published by the Department of Agriculture and Stock, Brisbane, either free or at a small charge, will give you the difference between sedges, grasses, and rushes. You should get your head teacher to obtain a copy for your school library.
3. *Malva parviflora,* marsh mallow.
4. *Chloris divaricata,* a native chloris or windmill grass. The native chloris grasses are very valuable fodders, particularly for sheep. When closely grazed they make a thick sward.
5. *Sporobolus Berteroanus,* Parramatta or rat's tail grass. This grass is an inferior fodder. It has caused some trouble of recent years through its invasion of the better paspalum patches.
6. *Bothriochloa decipiens,* bitter blue grass. An inferior blue grass sometimes known as coastal blue grass. It dominates many pastures due to the more palatable species having been eaten out. *Setaria* sp., a pigeon grass.
7. *Dicanthium sericeum,* blue grass.
8. Seed heads required for determination.
9. *Stachys arvensis,* stagger weed, also called wild mint, not to be confused with the mint weed of the Pittsworth area, which has received so much publicity of recent years owing to its poisonous properties. The present plant is a common weed of cultivation, particularly during the winter and spring months. It is quite a good fodder for dairy cattle, calves, and resting stock. It causes staggers and shivers in working horses and also stock that are travelling.

Shade and Shelter Trees.

G.C.B. (Wandoan)—

The following shade and shelter trees may be suitable for your purpose:—Kurrajong, bottle tree, pepper tree, white cedar, sebizzia lebbek, Burdekin plum, Portuguese elm. These could be obtained from the Director, Botanic Gardens, Brisbane, the charge being 2s. per tree. It is possible that you could obtain some of these trees, or other suitable trees, from Mr. L. Burbank, a nurseryman of Chinchilla. The Department has no trees for distribution. Both the wilga and the cypress pine are ornamental trees, and excellent for shade purposes. The wilga is often eaten by stock, and is of value on that account. You may be able to obtain seedlings of these trees somewhere in your district. Specimens of plants for identification should be sent to the Government Botanist, Botanic Gardens, Brisbane.

Poisonous Plants.

W.R. (Petrie)—

Swainsona luteola is a plant related to the indigo or Darling pea, and has been proved by feeding tests to affect stock in much the same way. Animals are said to have a crazed appearance for some time after eating the plant, and they have been taken off it. It is quite common in Queensland, and has several times been sent to us as a suspected poisonous plant. We have not heard a common name given to it.

Lotus australis, the native bird's-foot trefoil, frequently called Barwon lucerne, is generally regarded as an excellent fodder plant; but, like the frost-resistant Rhodes grass, sorghums, and some other plants, contain a prussic-acid-yielding glucoside. Losses from it among ordinary paddock stock, however, are rare. It is moderately common in Queensland, but little trouble with it has been experienced.

Under Suspicion.

L.L.M. (Charleville)—

1. *Euphorbia Drummondii*, caustic weed. This plant has been found to be cyanophoric in New South Wales, but repeated tests with Queensland specimens have always yielded negative results. Symptoms as almost given universally by stockowners are not those of typical HCN poisoning. The head and neck of the affected sheep swell considerably. If this swelling is pierced and an amber-coloured fluid exudes, the life of the sheep may be saved.

2. *Cucumis myriocarpus*, paddy melon. A native of South Africa now widely spread in many countries. It is a very common weed in Queensland. Both in Queensland and New South Wales it is said to have caused blindness in horses. So far as we know nothing definite has been proved against the plant in Queensland. In South Africa the juice has been found to be toxic.

3. *Eremophila maculata*, native fuchsia. A very common plant in many parts of the West. It is strongly cyanophoric. Most losses with it, however, as in some cases of cyanogenetic plants, seems to be from travelling stock, ordinary paddock resting stock frequently browse on the plant with impunity. In fact, most graziers look on it as quite a good fodder.

"Very Poisonous."

E.K. (Cunnamulla)—

Your specimen represents a species of *Datura* or thorn apple. It is difficult to say from a single leaf what actual species it is, but it looks like the common garden species, *Datura Cornucopia*. All species of *Datura* are very poisonous, and if your cows and calves had access to some of these plants, and have eaten any of them, it is more than likely they are the cause of the trouble.

Hog Weed.

M.R.M. (Mundubbera)—

The specimen represents *Trianthema decandra*, frequently known as hog weed, which is very common in Queensland. It is not known to possess any poisonous properties, and so far as we know has not come previously under suspicion as a poisonous plant. It belongs to a wholesome family of plants (*Aizoaceæ*), closely allied to the pig weeds. Some of the smaller members of the genus *Trianthema* are very common on the Western pastures, and are looked upon as quite good cattle feed.

Species of Roly Poly.

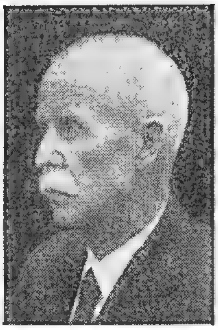
M.G. (Umbercollie, Goondiwindi)—

Your specimen is a species of roly poly, *Bassia tricuspis*, a native plant very closely allied to the galvanised burr. It is a very common weed in many parts of Queensland, particularly on the Darling Downs and in the Maranoa district. So far as is known the plant does not readily succumb to poisoning, or, at least, we doubt rather if poisoning would destroy the seeds it has all over it in tremendous quantities.

General Notes

In Memoriam.

JOHN NEWTON CREE.



The death of John N. Cree, formerly of the Maintenance Section of the Department of Agriculture and Stock, which occurred on August 10th is recorded with regret. The late Mr. Cree was born in 1864 at Bishop Auckland, Durham, England. He came to Queensland in 1884, and for many years was engaged in bridge building and other constructional work in different parts of the State. In 1912 he entered the service of the Department, in which he soon earned a high reputation for his industry, skill and faithful performance of duty—a reputation which he retained until his retirement in December, 1932. He is survived by his widow, a son and three daughters to whom sincere sympathy is extended.

Staff Changes and Appointments.

Mr. V. J. Brimblecombe, Gladstone, has been appointed an inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock, and will be stationed at Monto.

Miss M. H. Makings, Turner avenue, New Farm, has been appointed an assistant cane tester at Qunaba Mill.

Mr. N. E. D. Arthur, Inspector of Stock, Tibooburra, New South Wales, has been appointed also an acting inspector of stock for Queensland.

Constable R. W. G. Lake, Malbon, has been appointed also an inspector under the Brands Acts.

Sergeants (2nd Class) J. Doolan (Landsborough) and A. E. Wootton (Nundah) have been appointed also inspectors under the Slaughtering Act.

Mr. M. W. J. Patullo, Dalrymple Heights, Eungella, via Mackay, has been appointed an honorary ranger under the Animals and Birds Acts.

Mr. J. E. Ladewig, Stock, Slaughtering, and Dairy Inspector, has been transferred from Monto to Biloela.

Mr. J. A. Gresty, an officer of the Forestry Department stationed in the Lamington National Park area, has been appointed also an honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Constable J. H. Hancock, Wowan, has been appointed also an inspector under the Brands Acts.

Mr. J. T. Littleton, Inspector of Stock, Innisfail, has been appointed also an inspector of brands. The Officer in Charge of Police at Oaks (Kidston) has been appointed also an acting inspector of stock.

Mr. James Cormack, Gin Gin Sugar Mill, Wallaville, has been appointed millowners' representative on the Gin Gin Local Sugar Cane Prices Board, vice W. C. Cunningham, resigned.

The following have been appointed honorary rangers under the Animals and Birds Acts:—Messrs. E. G. Gray, E. W. Carless, L. J. Dowzer, W. A. Elliott, R. F. Clark, H. Cox, E. J. Gould, C. G. Hawkins (Ayr), E. W. Ford, junr., W. Haller, W. G. Wall, F. J. Woods (Home Hill), J. Sexton (Brandon), L. Freeland, J. B. Blakeney, W. C. Bird, W. Ludwig, E. A. Robinson, M. B. Mayes, J. T. Dakers, H. Pemble, F. G. Hughes, and T. W. Hourigan (Giru).

Wild Life Preservation.

Orders in Council have been issued under the Animals and Birds Acts declaring the property of Messrs. Fitzpatrick at Lake Clarendon, via Gatton, and an area embracing Myall Creek, Dalby, to be sanctuaries for the protection of animals and birds.

Banana Industry Protection Board.

An Order in Council has been issued under the Banana Industry Protection Act providing for a levy on banana growers to be used for the maintenance of the Banana Industry Protection Board. The levy is at the rate of 1½d. per one and a-half bushel case, and 2d. in the £ sterling on bananas marketed in the bunch.

Pineapple Levy.

A regulation has been issued under the Fruit Marketing Organisation Acts extending for a further twelve months from the 21st August, 1937, the Pineapple Levy Regulation which was issued in April, 1936, and which empowers the Committee of Direction of Fruit Marketing to make a levy for the purposes of the abovementioned Acts on all pineapples marketed.

Peanut Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts extending the operations of the Peanut Board for the period from the 28th August, 1940, to the 27th August, 1947.

Peanut Board Election.

Result of the Peanut Board election (four members required:—

District No. 1 (Wienholt and Nanango), two members—Adermann, Charles Frederick, Kingaroy, 228 votes; Young, Leslie Vivian, Wooroolin, 204 votes; Christiansen, Norman James, Wooroolin, 101 votes; Crawford, Joseph Henry, Mannuen road, Kingaroy, 97 votes.

District No. 2 (Central Queensland), one member—Nothling, Rudolf Richard, Hut Creek, re-elected unopposed.

District No. 3 (Rest of Queensland), one member—Quilter, John Francis, Tolga, 40 votes; Gargan, John, Atherton, 31 votes; Humphrey, Sydney Harold, Tolga, 9 votes.

The sitting members for District No. 1 have been re-elected, and in District No. 3 Mr. Quilter will replace the present member, Mr. W. Whiting, who did not seek re-election this year.

The new Board will be appointed for a period of three years.

Council of Agriculture.

A regulation has been issued under the Primary Producers' Organisation and Marketing Acts prescribing the members of commodity boards who shall represent such boards on the Council of Agriculture. These include Messrs. J. McRobert (Maryborough) and W. J. Sloan (Malanda) (Butter Board), D. G. O'Shea (Southbrook) (Cheese Board), H. R. Brake (Wowan) (Cotton Board), T. D. McGeehan (Kairi) (Atherton Maize Board), C. Brumm (Woongoolba) (Arrowroot Board), C. F. Aderman (Kingaroy) (Peanut Board), R. V. Woodrow (Woodford) (Honey Board), E. Fitzgerald (Albany) (Barley Board), M. H. Campbell (Albany Creek) (Egg Board), H. Zischke (Hatton Vale) (Broom Millet Board), G. D. O'Neill (Allora) (Canary Seed Board), D. Johnston (Malanda) (Northern Pig Board), K. R. Hack (Nerang) (Committee of Direction of Fruit Marketing), G. Johnson (Mirani, Mackay) (Queensland Cane Growers' Council), W. J. Brimblecombe (Pirrinuan) (Wheat Board), G. A. Duffy (Forestry Department) (Plywood and Veneer and Northern Plywood and Veneer Boards).

Executive approval has also been given to the appointment of representatives of districts embracing Local Producers' Associations who shall be members of the Council of Agriculture. These are:—Messrs. R. R. Nothling, Hut Creek, via Ambrose (Central Queensland), R. H. Jamieson, Monto (Burnett), W. L. Osborne, Wondai (South Burnett), P. Daley, Maleny (Wide Bay), C. Bateman, Nundah (East Moreton), J. A. Sweeney, Mount Alford (West Moreton), J. Cameron, Lavelle (Darling Downs), W. E. Ashford, Hannaford, via Dalby (Western Downs), and C. W. Roseblade, Yungaburra (Atherton Tableland).

Cotton Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Cotton Board in respect of the establishment of a revolving fund in connection with the working account reserve fund moneys deducted from net realisations due to cotton growers

Rural Topics

Overstocking of Pastures.

That a large proportion of the most productive pastures of the State, coastal as well as inland, are overstocked is an undeniable fact. Unfortunately, too, the recent drought in the coastal areas has emphasised the harmful results of overstocking. The farms which were very much overstocked before the drought had the heaviest losses through its incidence. Many farmers and pastoralists are fully conscious of the bad effects of overstocking on pastures, and a large proportion of them insist on a moderate and judicious stocking of their holdings. As a consequence they are frequently very successful in good seasons and are the last to be affected by adverse seasons.

In a large proportion of cases, overstocking is due to economic conditions. Landholders often feel compelled to stock their properties to the limit during favourable seasons. Any general attack on the problem of overstocking, therefore, must inevitably involve financial considerations. It, however, is advantageous, invariably, even from the economic standpoint, not to overtax the productive capacity of the pastures.

Pastures which are not heavily stocked usually make rapid growth in the late summer and autumn, when the rainfall is sufficient. This is the case notably in some of the best paspalum pastures on the coast. This excess growth of grass is not eaten by stock, and when dry serves to protect the younger growth of grass from frost during the winter. With the approach of spring the younger growth of grass makes rapid headway, and forms a luscious pasture for stock. The general fertility of the soil of a pasture maintained in this way deteriorates much less rapidly than that of a pasture which is overstocked. The excess grass as it lodges and rots is added to the soil, and augments its organic constituents. Although this surplus late summer grass has a comparatively low feeding value on account of its low protein content, it has a high manurial value. It is composed very largely of organic matter which after decomposition has a marked reducing effect on essential soil minerals such as iron. It is due to this reducing effect of these organic constituents that the iron in the upper layers of the soil becomes soluble and available to pasture plants, fruit trees, and other economic crops.

—*W. D. Francis.*

On Nappamerrie—A "Desert" Vignette.

The fine stone house is clear of sand; the garden is of bougainvillea, fan-palm and cedar; and before and below is a great lagoon eight miles long and half a mile wide. A reedy island rises from the centre of this lake, whose depth is as much as 60 feet. . . .

In these hot brilliant days—sun saturated—of the alleged winter travelling is a joy. The long wide plain—gently rolling country from horizon to horizon; roly poly, or as Americans call it, "tumbleweed," rotates before the gentle wind, sowing seed as it travels.

A mob of horses full of curiosity, tinged with fear, gallop towards the car, wheeling within 200 yards of us and galloping away again, but to return. There is energy in a diet of Mitchell grass, yellowing on its stalk to a self-made hay; a great kick in the herbage, although the rainfall is low enough almost to justify the professors who study only tabulated rainfall and speak of the country as "desert."

Galahs by the thousand wheeling all at once, so that the sunlight strikes a flash of pink from their thousands of breasts; kangaroos bursting out of a scrub belt, rushing to concealment in another—life, warmth, sunlight, hot days, and cool nights, that are the ideal conditions for the production of Australia's finest wools. This is the "desert" of the text-books.

—*Randolph Bedford in "On the Western Edge."*

Orchard Notes

OCTOBER.

THE COASTAL DISTRICTS.

OCTOBER is frequently a dry month over the greater part of Queensland, consequently the advice that has been given in the notes for August and September regarding the necessity of thorough cultivation to retain moisture may be again emphasised. Thorough cultivation of all orchards, vineyards, and plantations therefore is imperative if the weather is dry, as the surface soil must be kept in a state of soil mulch, and no weeds of any kind must be allowed to grow, as they act only as pumps to draw out the moisture from the soil that is required by the trees or fruit-yielding plants.

All newly planted trees should be watched carefully and if they show the slightest sign of scale insects or other pests they should receive attention at once.

Bananas.

In the warmer districts banana planting may be continued. All winter trash should be removed and the stools cleaned up. If not already done, before the winter, young plantations planted the previous season should be desuckered without delay. Those desuckered last autumn should be gone over again, and old plantations also should receive attention. Grow to each stool the number of stems which experience proves to be permissible, but only allow each stem to grow a single follower. Borers will be active again soon, and trapping should be intensified towards the end of the month and supplies of Paris green and flour (one part to six by weight) made up in readiness. Caterpillar and grasshopper plagues often occur from the end of the month onwards, and it is wise to lay in a supply of arsenic pentoxide for use in the preparation of bran baits. Watch the plantation carefully for bunchy top, and kerosene and destroy any affected plants without delay. The season of vigorous growth is now commencing, and it will pay well in more and better fruit and in stronger suckers for the next crop to apply a dressing of a complete fertilizer to each stool. Cultivate well to retain moisture, aerate the soil, and kill weeds before they seed. This will also prepare the soil for the planting next month of a green cover crop such as *Crotalaria goreensis*, thus shading the soil, preventing erosion on slopes, and enriching the soil with nitrogen and humus.

Clean out all banana refuse from the packing shed, and resolve not to allow it to accumulate in future. This will reduce the risk of the development of many fungous rots in the packed fruit.

Pineapples.

From now onwards pineapples may be planted in most districts. Plough thoroughly, remembering always that in the life of a plantation will be several years during which it will be neither possible nor desirable to do more than disturb the surface layer. Obtain advice from the Department of Agriculture and Stock as to whether the soil is sufficiently acid, and, if not, how much sulphur to apply. Care must be taken in the layout of the rows to save time and labour in cultivation and harvesting, and minimise erosion. Select planting material with discrimination from healthy and vigorous plants of a good bearing type. Beware of planting "collars of slips." Always strip off the base leaves and dry in the sun for a few days, and plant shallow. As soon as the roots form, apply 3 cwt. of 10-6-10 fertilizer to the acre. All established plantations are due for their spring fertilizer at the rate of not less than 5 cwt. per acre. Keep down weeds with the Dutch hoe; but do not disturb the soil deeply, always remembering that the pineapple is shallow-rooted and receives a sharp setback if the roots are interfered with by the use of horse-drawn implements. Clean out all pineapple refuse from the packing shed and surroundings, and thus eliminate much fungous trouble in the summer pack.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

MUCH of the matter contained under the heading of "The Coastal Districts" applies equally to the Granite Belt, and the Southern and Central Tablelands; for on the spring treatment that the orchard and vineyard receives the succeeding crop of fruit very largely depends. The surface of all orchards and vineyards must be kept loose, and no weed growth of any kind should be allowed. In the western districts, irrigation should be given whenever necessary, but growers must not rely on irrigation alone, but should combine it with the thorough cultivation of the land so as to form and keep a fine soil mulch that will prevent surface evaporation.

All newly planted trees should be looked after carefully and only permitted to grow the branches required to form the future tree. All others should be removed as soon as they make their appearance. If there is any sign of woolly aphis, peach aphis, or scale insects, or of any fungus disease on the young trees, these diseases should be dealt with at once by the use of such remedies as black leaf forty, Bordeaux mixture, or a weak oil emulsion. In older trees, similar pests should be systematically fought, as if kept in check at the beginning of the season the crop of fruit will not suffer to any appreciable extent. Where brown rot has been present in previous years, the trees should be sprayed with Bordeaux mixture and lime sulphur according to the schedule recommended by the Department. All pear, apple, and quince trees should be sprayed with arsenate of lead—first when the blossom is falling, and at intervals of about three weeks. Spraying for codlin moth is compulsory in the fruit district of Stanthorpe, and wherever pomaceous fruit is grown it must be attended to if this insect is to be kept in check.

In the warmer parts a careful check should be kept for any appearance of the fruit fly, and, should it be found, every effort should be made to trap the mature insect and to gather and destroy any affected fruit. If this is done, there is a good chance of saving the earlier ripening summer fruit, if not the bulk of the crop. Tomato and potato crops will require spraying with Bordeaux mixture, as also will grape vines. Keep a very strict watch on all grape vines, and, if they have not been treated already, do not delay a day in spraying if any sign of an oil spot, the first indication of downy mildew, appears on the top surface of the leaf. Spraying with Bordeaux mixture at once, and following the first spraying up with subsequent sprayings, if necessary, will save the crop, but if this is not done and the season is favourable for the development of the particular fungus causing this disease, growers can rest assured that their grape crop will not take long to harvest.

Where new vineyards have been planted, spraying also is very necessary, as if this is not done the young leaves and growth are apt to be affected so badly that the plant will die.

SHEEP LAND FOR GRAZING HOMESTEAD SELECTION.

Portions 1 and 4, parish of Whittingham, comprising part of Alice Downs resumption, will be open for Grazing Homestead Selection at the Land Office, Blackall, on Thursday, 7th October, 1937, at 11 o'clock a.m.

The portions are situated about 20 miles north-west of Blackall. The areas are 20,099 acres and 20,210 acres respectively.

Each selection will be for a term of twenty-eight years, and the annual rental for the first period of seven years is 3¾d. and 4d. per acre respectively. Each must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years.

Portion 1 comprises open downs with some gidyea and boree forest, and portion 4 is nicely shaded first-class downs. Portion 1 is naturally watered, but portion 4 requires further artificial water. Both portions are well grassed with Mitchell, Flinders, barley, umbrella, and other grasses, and are suitable for breeding, woolgrowing, and fattening.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agents at Blackall and Barcaldine, and the Government Tourist Bureaux, Sydney and Melbourne.

Farm Notes

OCTOBER.

FIELD.—With the advent of warmer weather and the consequent increase in the soil temperature, weeds will make great headway if not checked; therefore, our advice for last month holds good with even greater force for the coming month. Earth up any crops which may require it, and keep the soil loose among them. Sow maize, cowpeas, sorghums, millet, panicums, pumpkins, melons, cucumbers, marrows. Plant sweet potatoes, yams, peanuts, arrowroot and ginger. Coffee plants may be planted out. There are voluminous articles in previous journals giving full instructions how to manage coffee plants from preparing the ground to harvesting the crop.

WORMS IN SHEEP.

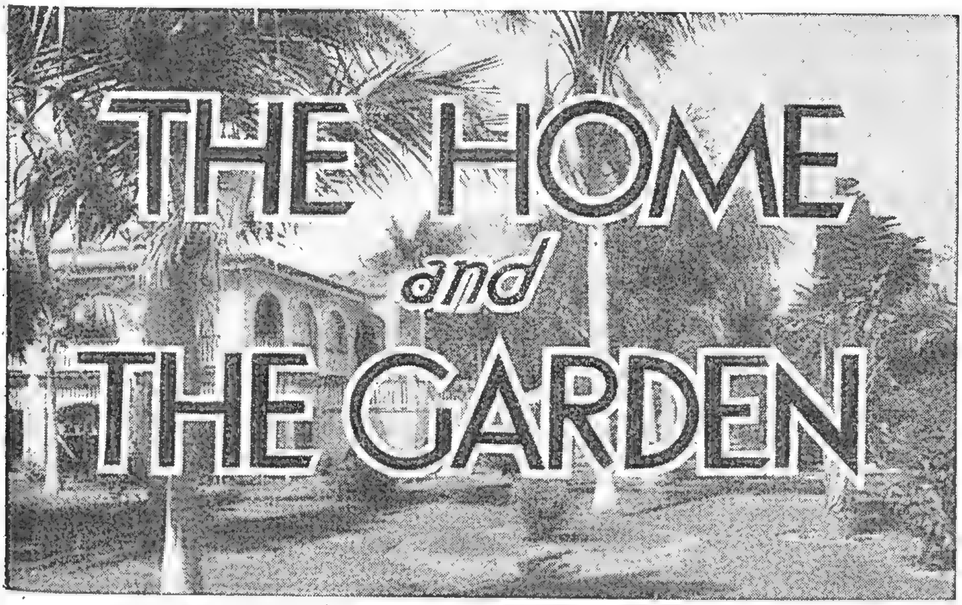
In recent times the problem of control of the parasitic worms in sheep has claimed attention in different parts of the world, more especially in South Africa, Great Britain, and Australia. Previously, drug treatment was successful only in the case of the stomach worm. Worms inhabiting the small intestine, e.g., the hair worms, and the large bowel, e.g., the nodule worm, were practically unaffected by drugs given in the ordinary way through the mouth. This was due to the fact that, under the conditions usually accompanying treatment, the drug passed into the first stomach or paunch and thus became diluted to such a degree that, by the time it passed through the three remaining stomachs of the sheep, it reached the small intestine in too weak a concentration to be in any way effective against the worms situated there or lower down in the gut.

The process of swallowing in sheep is governed by a groove which passes from the gullet along the roof of the first and second stomachs and eventually into the fourth stomach, which then leads directly into the small intestine. When the sheep grazes the food is passed directly into the paunch, to be later brought back into the mouth, chewed as a cud, and then swallowed again. This time, however, the groove closes and the thoroughly masticated food goes direct to the third stomach or bible and then is passed on with little delay into the fourth stomach. When the sheep drinks the groove is again closed and the water passes almost directly into the fourth stomach. It was therefore considered that if some way could be found of getting this groove to close during treatment the drug would pass directly into the fourth stomach and would reach the worms in the small intestine and large bowel in a sufficiently high concentration to kill most of them.

After a large number of experiments copper sulphate was found to produce this effect. Various strengths from 1 per cent. to 10 per cent. were tried, and it was found that a very small quantity of a 5-10 per cent. solution gave very consistent results. This work was carried out simultaneously in Australia and South Africa. For the small hair worms nicotine sulphate was then combined with the copper sulphate, with very excellent results. This drench was found to be effective against both stomach worms and tape worms. Another point which was brought out by this was that starvation before drenching was not desirable. It was previously considered that, by a starvation period prior to drenching, the locality in which the worms were present would be rendered free of ingested food and better contact of the drug with the worms would be given. It subsequently was found that this was more likely to be achieved without starvation, for with starvation the animals brought up the food from the first stomach, ruminated it, and then swallowed it, thus surrounding the worms in the third and fourth stomachs and in the small intestine with the ingested material. Details of this treatment may be obtained on application to the Animal Health Station.

In South Africa work along these lines has been continued against the nodule worm. It was found that by first placing in the mouth 2½ c.c. of a 10 per cent. copper sulphate solution the groove closed, and then by giving immediately afterwards a powder of copper tratrate, copper arsenate, and calcium hydroxide, a high efficiency against the nodule worm could be secured by two treatments on successive days. This treatment is now being tested in Australia, and is not yet available to the grazier.

—*Dr. F. H. S. Roberts.*



OUR BABIES.

Under this heading a series of short articles, by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

BABY'S BATH.

THE hour at which baby is bathed will vary with the requirements of different households. Some mothers may find it convenient to bath baby just before his second feeding time (say, between 9 and 10 o'clock in the morning). Whatever the hour chosen, it must be adhered to, so as not to upset the rhythm of baby's day. Of course, baby must never be bathed unless an hour (preferably more) has elapsed since his last feed.

Before starting to undress baby every precaution should be taken, in cold weather, to prevent loss of heat before, during, and after the bath. Undress, bath, and dress quickly, with no delay or dawdling and no unnecessary exposure of the skin. Choose a cosy corner or a warmed room, using a screen if necessary to protect baby from draughts. Prepare everything before lifting baby from his cot. Have dry, warm towels, washers, baby clothing, and all other requirements ready to hand.

When filling the bath always pour in the cold water first, lest the baby, if old enough, or his little brother or sister tumble in, and is badly or even fatally scalded. Then add sufficient hot water to make it comfortably warm, testing it carefully by putting your elbow, not your hand, into it just before putting the baby in.

It is not generally known that when the strong, healthy baby is a few months old he enjoys and derives benefit from being gradually accustomed to having tepid and, later, cool water squeezed over him before being removed from the bath. Let this be followed by a good

brisk rub down. Great care should be taken in cleansing and drying eyes, ears, lips, and folds of the skin. For this a gentle dabbing motion is best, and on no account should the mouth be wiped out. Nature provides natural juices in the mouth for perfect cleanliness. Any mild, superfatted soap may be used, but *use sparingly.* If used on the head great care must be taken to see that it is thoroughly rinsed off again, as any trace left is apt to cause dandruff and cradle-cap. Do not be afraid to dry the scalp thoroughly. Firm rubbing will not injure the baby through the soft spot.

Have two washers made from soft towelling or cellular cotton—one for his body, the other for his face. If preferred the face washer may be made from two or three folds of butter muslin. The washers must be boiled frequently. Do not use a sponge; it is hard to keep clean, and is liable to become foul and slimy and infested with microbes. Provide two towels also—a face towel and a body towel. The former should be made of soft absorbent material, such as butter muslin, and the latter of ordinary Turkish towelling, preferably linen. As a general rule powder is not needed. The baby should be dried so thoroughly that powder is quite unnecessary. If used carelessly, the powder tends to cake in the folds of the skin and to cause irritation and subsequent rawness. The folds of the skin should be dried with a towel, not with powder.

General Rules for Bathing.

1. Bath in a cosy corner of the room, using a screen if necessary to protect baby from draught.

2. Have everything in readiness before lifting baby from his cot.

3. Bath baby quickly. Remember, bathtime is not playtime.

4. Do not take baby out of a heated room before first wrapping him cosily in a shawl or blanket.

IN THE FARM KITCHEN.

SOME POTATO DISHES.

If, when boiling potatoes, you have them entirely covered with water, they will not turn black.

When baked potatoes are wanted, and there is little time to cook them, boil for fifteen minutes before baking. When roasted potatoes are wanted quickly, boil quickly for two minutes, drain well, steam till dry, then place with fat in a roasting tin under the roast. Turn them in the fat, so that they are greasy all over, before roasting.

Potato Chips.

Peel and wash the potatoes. Dry well. Cut in lengths of equal thickness moderately so to serve with grills or into strips like matches for cocktail chips, or trim the potato at each end, then cut into rounds the size of a crown-piece, or slice them very thinly to make crisps. No matter which way you cut them, make the frying fat hot, but it must on no account boil. Put a few potatoes in the frying basket. Plunge the basket into the fat. Cook the potatoes over a moderate heat till tender and slightly coloured. Remove the basket at once. Place the potatoes on a sieve to get partly cold. Replace the fat on the fire, and when it steams a blue vapour plunge the potatoes in a second time. Shake them about in the basket till they are swollen and crisp. Remove at once. When frying these do not put too many in the frying basket at once.

Lyonnaise Potatoes.

Take 1 pint cold boiled potatoes, ½ teaspoonful salt, 1½ tablespoonfuls chopped parsley, 1 teaspoonful chopped onion, 2 tablespoonfuls dripping, pepper to taste.

Slice the potatoes. Season with pepper and salt. Fry the onion in dripping until light brown. Add the potato and cook till all the fat is absorbed. Add the chopped parsley and serve with any cold meat.

Potato Dumplings.

Take 6 potatoes, 2 eggs, ½ cupful margarine, ¼ teaspoonful crushed herbs, 1½ teaspoonfuls salt, ½ cupful flour, ½ teaspoonful minced parsley.

Boil the potatoes, choosing medium-sized ones. Drain when ready. Steam to dry them, and mash when cold. Stir in the eggs, salt, flour, and seasoning. Mix and knead well till smooth. Shape into one long thick roll. Cut into half-inch pieces. Roll into dumplings the size of your finger. Cook in soup or boiling salted water for ten minutes. Drain in a colander. Place in a hot serving dish. Pour melted butter, cooked till brown, over the dumplings when served. If cooked in soup, serve the dumplings in the tureen with the soup.

Potato Croquettes.

Take 3 cupfuls hot mashed potato, 1 teaspoonful salt, 1 egg, pinch pepper, 2 tablespoonfuls butter or margarine, 1 teaspoonful minced parsley, 1 teaspoonful minced onion (this may be omitted), flour.

Put the potatoes, butter, salt, pepper, parsley, and onion into a basin, and mix well together with a wooden spoon. Cool. Shape into balls or potato shape. Roll in flour. Dip in lightly-beaten egg and coat with breadcrumbs. Fry in deep, smoking hot fat for three minutes. Drain and serve.

Stuffed Potatoes.

Take 6 baked potatoes, ¾ cupful grated cheese, 1 teaspoonful salt, ¼ cupful hot milk, 2 tablespoonfuls margarine (or butter).

Use large potatoes of good shape. When potatoes are soft, halve lengthwise. Scoop the inside into a saucepan. Mash. Mix with margarine, salt, milk, and pepper to taste. Return to the shells. Sprinkle with cheese. Place dabs of margarine on top. Bake in a baking tin in a moderate oven for five to ten minutes till crisp and brown on top.

Devilled Potatoes.

Take 18 new potatoes, 1½ tablespoonfuls butter, 1 egg-yolk, ¾ teaspoonful mixed mustard, 1½ teaspoonfuls vinegar, lard for frying, salt and pepper.

Boil potatoes, but not long enough to break. Drain, and melt lard to fry them in. When hot, drop in the potatoes. Fry five minutes, lift out, drain quickly, and turn into a saucepan containing the melted butter mixed with the mustard. Sprinkle vinegar over, season, and cook for three minutes, shaking constantly. Remove from the heat and strain off liquor. Stir in the beaten egg-yolk, add potatoes, heat well, and serve at once.

Baked Potato Mash.

Take 2 cupfuls cold mashed potatoes, 2 tablespoonfuls melted margarine, 1 egg, 1 cupful milk, pepper and salt.

Beat the margarine well into the potatoes. Stir in the well-beaten egg-yolk, milk, and lastly the stiffly frothed egg-white. Season to taste with salt and pepper. Bake in greased fireproof dish in a quick oven. Serve immediately.

Scalloped Potatoes.

Take 2 lb. potatoes, 3 to 4 oz. cheese, 1½ oz. butter, 2½ gills milk, salt and pepper, 1½ oz. flour.

Peel the potatoes, wash them and cut into thin slices. Put them into a buttered pie-dish in layers, sprinkling each layer with flour, pepper, salt, finely-grated cheese, and dabs of butter. Pour in the milk, sprinkle cheese on top, cover dish with a buttered paper, and bake the potatoes in a moderately hot oven for about one hour and a-half, until the potatoes are tender.

Duchesse Potatoes.

Take 1 lb. potatoes, 1 oz. butter, 1 egg, 2 tablespoonfuls milk, 1 oz. flour, salt and pepper.

Wash, peel, and boil the potatoes and drain them. Add the butter and milk and mash the potatoes with a fork. Beat the egg and mix nearly all of it with the potatoes. Season with salt and pepper. Turn potatoes on to a floured board and shake into five or six squares. Put in a flat baking tin and brush the tops with the remainder of the egg. Bake in a quick oven for ten to fifteen minutes.

Cream of Potatoes.

Take 2 lb. potatoes, 1 oz. butter, ½ pint milk, 1½ quarts water, 3 large onions, 1 teaspoonful minced parsley, salt and pepper.

Peel and slice the potatoes into a saucepan. Add the peel and sliced onions, water, and pepper and salt to taste. Cover and simmer two hours. Rub through a sieve and return to the saucepan. Add butter. Bring to the boil and whisk in boiling milk with an egg-beater. Add parsley and serve at once.

Hungarian Potatoes.

Take 3 cupfuls diced potatoes, 1 egg-yolk, 3 tablespoonfuls beef dripping, 2 tablespoonfuls flour, 1 teaspoonful minced onion, 1 cupful hot milk, 1 teaspoonful chopped parsley, 2 tablespoonfuls butter, salt, pepper, and paprika to taste.

Wash and peel potatoes before cutting them into cubes one-third of an inch square. Place in a saucepan. Cover with water, bring to the boil, and boil three minutes. Then drain well, melt dripping in frying pan, add potatoes, and cook on a low flame until potatoes are soft and lightly brown. Melt butter in a saucepan, add onion, cook for half a minute, then stir in flour and hot milk. Season to taste with salt, pepper, and paprika, then stir in egg-yolk. Pour sauce over potatoes and sprinkle with parsley.

Angus Potato Soup.

Take 1 lb. roast beef bones, 2 quarts water, 1 large carrot, 2 largo tomatoes, 10 potatoes, 2 medium onions, seasoning.

Place the bones in a saucepan. Add water. Cover and simmer for one hour. Uncover and add the peeled and chopped onions, and potatoes, minced carrot, and scalded and peeled tomato. Simmer slowly for one and a half hours. Season to taste and serve very hot.

IN A WESTERN GARDEN.

Mr. Hughes's garden at Nockatunga shows a fruit production easy to all this western country. Soil is right. Sun heat is right. And when to these are added irrigation California and Mildura and Leeton have never bettered it. In 1910 I first saw New Mexico, and its soil was generally so poor that I doubt if there is much in Australia to compare with it. I passed through again in 1921, and in the eleven years intervening irrigation had made the desert a garden.

At Nockatunga, on water and white sand, grow grapes, oranges, persimmons, melons, cauliflower, and root-crops to perfection. An all-steel waggon—for in this dry air waggons of wood fall to pieces—drawn by six camels and loaded with goat manure, carries the fertilizer to the crop. The Chinese gardeners will not use cow manure, and their selection of fertilizers is backed by results. Citrus fruits—almost equalling the oranges and grape fruit that were a feature of the 1937 show at Charleville—grow in plenty, the trees so heavily laden that some of the bearing branches trail upon the earth.

Nockatunga, a homestead of pisé, cool and wire-screened, is a sample of the station houses built when the old-time pastoralist had got over the hard work of the run, and could find time to make comfort for himself. Most of these more comfortable houses were built in the time of sheep. The work among cattle is more crude, and, generally, the cattleman's homestead reflects his work.

The sheepman is more settled. In growing the finer Australian wools he knows that the product will almost never know a glutted market. The homes of grazing selectors around the Quilpie district are modern houses, wire-screened, and some electrically lighted and refrigerated. They are an insurance of permanence in the settlement of this far-western region.

Nappamerrie, Nockatunga, and the beautiful palms, lawns, and gardens of Mount Margaret stay in the memory.—Randolph Bedford in "On the Western Edge."

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JULY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and stations.	Average Rainfall.		Total Rainfall.	
	July.	No. of years' records.	July, 1937.	July, 1936.
North Coast.	In.		In.	In.
Atherton	1·03	36	3·44	2·07
Cairns	1·54	55	3·66	1·74
Cardwell	1·35	65	2·08	1·28
Cooktown	0·96	61	1·12	1·45
Herberton	0·85	51	1·66	1·16
Ingham	1·61	45	2·75	1·19
Innisfail	4·64	56	10·62	7·18
Mossman Mill	1·25	24	2·71	1·20
Townsville	0·61	66	0·62	0·27
Central Coast.				
Ayr	0·68	50	0·37	..
Bowen	0·93	66	0·47	..
Charters Towers	0·64	55	0·43	0·30
Mackay	1·68	66	0·90	0·55
Prosperine	1·55	34	1·25	1·36
St. Lawrence	1·39	66	0·51	0·23
South Coast.				
Biggenden	1·38	38	0·90	0·34
Bundaberg	1·84	54	1·60	0·75
Brisbane	2·23	85	1·15	1·31
Caboolture	2·18	50	0·73	1·28
Childers	1·69	42	2·08	0·54
Crohamhurst	2·98	44	1·42	1·80
Esk	1·98	50	0·65	1·56
Gayndah	1·46	66	1·45	0·46
Gympie	2·11	67	0·96	1·17
Kilkivan	1·60	58	0·69	0·45
Maryborough	1·91	66	2·54	1·48
Nambour	2·69	41	2·12	1·12
Nanango	1·66	55	0·95	1·24
Rockhampton	1·77	66	1·89	0·40
Woodford	2·37	50	0·61	1·57

Divisions and stations.	Average Rainfall.		Total Rainfall.	
	July.	No. of years' records.	July, 1937.	July, 1936.
Central Highlands.	In.		In.	In.
Clermont	1·04	66	0·80	0·73
Gindie	1·13	38	..	0·71
Springsure	1·23	68	0·43	1·80
Darling Downs.				
Dalby	1·74	67	0·97	2·00
Emu Vale	1·61	41	0·88	2·59
Hermitage	1·75	31	0·74	1·48
Jimbour	1·54	49	0·86	2·05
Miles	1·66	52	0·86	2·50
Stanthorpe	2·05	64	0·90	2·87
Toowoomba	2·11	65	1·08	2·40
Warwick	1·86	72	0·82	2·50
Maranoa.				
Roma	1·48	63	0·60	1·69
State Farms, &c.				
Bungeworgorai	1·43	22	..	1·20
Gatton College	1·42	38	0·98	1·47
Kairi	1·11	21	..	..
Mackay Sugar Experiment Station	1·50	40	0·50	0·45

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JULY, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure. at 9 a.m.	Shade Temperature. Means.		Shade Temperature. Extremes.				Rainfall.	
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·99	74	65	81	21	61	10, 12	112	7
Herberton	..	66	53	77	1	42	6, 7	166	13
Rockhampton	30·20	72	53	80	23	40	6	189	7
Brisbane	30·27	68	50	77	23	42	2, 3	115	13
Darling Downs.									
Dalby	30·28	67	38	74	18	28	4	97	3
Stanthorpe	..	55	32	66	20	18	4	90	6
Toowoomba	..	63	42	71	18	32	6, 26	108	4
Mid-Interior.									
Georgetown	30·05	80	56	86	23, 31	41	25	Nil	..
Longreach	30·20	73	45	80	19, 21	34	5, 6	38	3
Mitchell	30·29	65	35	74	21	25	4, 5	88	3
Western									
Burketown	30·06	81	56	88	22	45	6	Nil	..
Boulia	30·21	73	46	83	31	37	6	Nil	..
Thargomindah	30·27	66	40	78	31	32	5, 25	Nil	..

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	September. 1937.		October. 1937.		MOONRISE. Sept. 1937.	MOONRISE. Oct. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	6·7	5·37	5·33	5·51	2·56	3·4
2	6·6	5·37	5·32	5·51	3·45	3·43
3	6·5	5·38	5·31	5·52	4·27	4·18
4	6·4	5·38	5·29	5·53	5·6	4·53
5	6·3	5·39	5·28	5·53	5 43	5·28
6	6·2	5·39	5·27	5·54	6·19	6·5
7	6·1	5·40	5·26	5·54	6·54	6·43
8	5·58	5·40	5·25	5·55	7·29	7·24
9	5·57	5·41	5·24	5·55	8·6	8·6
10	5·56	5·41	5·23	5·56	8·46	8·52
11	5·55	5·42	5·22	5·56	9·26	9·42
12	5·53	5·42	5·21	5·57	10·10	10·34
13	5·52	5·43	5·20	5·57	10·59	11·29
						p.m.
14	5·51	5·43	5·19	5·58	11·51	12·25
					p.m.	
15	5·50	5·44	5·18	5·58	12 46	1·20
16	5·49	5·44	5·17	5·59	1·40	2·17
17	5·48	5·45	5·16	6·59	2·37	3·17
18	5·47	5·45	5·15	6·0	3·36	4·18
19	5·45	5·45	5·14	6·1	4·35	5·21
20	5·44	5·46	5·12	6 1	5·34	6·29
21	5·43	5 46	5·11	6·2	6·36	7·37
22	5·42	5·47	5 10	6·3	7·36	8·33
23	5·41	5·47	5·9	6·3	8·48	9·46
24	5·40	5·47	5·8	6·4	9.54	10·46
25	5·39	5·48	5·8	6·5	10·56	11·37
26	5·38	5·48	5·7	6·5	11·58	a.m.
27	5·37	5·49	5·6	6·6	..	12·23
					a.m.	
28	5·36	5·49	5·6	6·7	12·52	1·6
29	5·35	5·50	5·5	6·7	1·40	1·44
30	5·34	5·50	5·4	6·8	2·24	2·19
31			5·3	6·9		2·53

Phases of the Moon, Occultations, &c.

5th Sept.	● New Moon	8 54 a.m.
13th ,,	☽ First Quarter	6 57 a.m.
20th ,,	○ Full Moon	9 32 p.m.
27th ,,	☾ Last Quarter	3 43 p.m.

Apogee, 12th September, at 8 a.m.
Perigee, 24th September, at 7 a.m.

An interesting phenomenon will occur in the early morning of the 24th, when Venus, in Leo, rising at 3.55 a.m., will be separated by only about a fourth of a degree from Regulus, the first magnitude star on the ecliptic. An interested observer may see them until all but the brightest stars are lost in the approaching daylight.

On the 25th Saturn will be in opposition to the Sun, rising as the Sun sets. It will then be very near the position in Pisces where the Sun crosses the celestial equator on the 21st March. Northward and a little to the east of Saturn are the two stars which mark the eastern side of the Great Square of Pegasus.

On the 30th Mercury will arrive at its greatest distance, 18 degrees west of the Sun. Rising at 4.24 a.m., the swiftest planet will be near the invisible and most tardy of all planets, Neptune, on the outskirts of the solar system, taking 164 years to complete a circuit around the Sun, whereas Mercury, nearest the Sun, runs through all the twelve Zodiacal constellations in 87 days.

Mercury rises at 6.54 a.m., 47 minutes after the Sun, and sets at 7.16 p.m., 1 hour 39 minutes after it, on the 1st; on the 15th it rises at 5.35 a.m., 15 minutes before the Sun, and sets at 5.39 p.m., 5 minutes before it.

Venus rises at 4.5 a.m., 2 hours 2 minutes before the Sun, and sets at 2.47 p.m., 2 hours 50 minutes before it, on the 1st; on the 15th it rises at 4.8 a.m., 1 hour 42 minutes before the Sun, and sets at 3.8 p.m., 2 hours 36 minutes before it.

Mars rises at 10.53 a.m. on the 1st and sets at 12.51 a.m. on the 2nd; on the 15th it rises at 10.31 a.m. and sets at 12.35 a.m. on the 16th.

Jupiter rises at 1.36 p.m. on the 1st, and sets at 3.34 a.m. on the 2nd; on the 15th it rises at 12.38 p.m. and sets at 2.28 a.m. on the 16th.

Saturn rises at 7.26 p.m. on the 1st and sets at 7.34 a.m. on the 2nd; on the 15th it rises at 6.23 p.m. and sets at 6.37 a.m. on the 16th.

The Southern Cross will be at its lowest position about 2 a.m., and therefore disappear at Warwick about midnight at the beginning of the month and 2 hours earlier at the end.

4th Oct.	● New Moon	9 58 p.m.
13th ,,	☽ First Quarter	1 47 a.m.
20th ,,	○ Full Moon	7 48 a.m.
26th ,,	☾ Last Quarter	11 26 a.m.

Apogee, 10th October, at 4 a.m.
Perigee, 22nd October, at 2 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate; as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling,** members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.

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Event and Comment

Prospects of the Coastal Cattle-fattening Scheme.

FAVOURABLE reports of the cattle-fattening scheme on coastal country in the far North, which was inaugurated by the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, in co-operation with Mr. Brice Henry, of Tully, continue to come to hand. Other graziers have since become interested in the scheme, towards the success of which considerable progress has been made. Of the meat exported from the Commonwealth to the United Kingdom in 1936-37, Queensland contributed 45.58 per cent. of the total. The coastal fattening scheme, therefore, promises to have considerable influence on the further development of the chilled beef export industry.

Chilled Beef Export.

IN the annual report of the Queensland Meat Industry Board, it is stated that the shipment of chilled beef from the Dominions is the most interesting development in the world's meat trade since the introduction of mechanical refrigeration. Exports from Empire countries were confined formerly to frozen and canned beef. "This limitation largely was responsible for the relatively small inducement offered for the improvement of beef cattle herds and cattle properties." The

report goes on to state that Empire countries in a relatively short time have made substantial progress in the shipment of chilled beef. The number of quarters shipped from Australia exceeds greatly that from any of the other countries indicated, and there is yet the opportunity for a considerable expansion of the trade from this country. For the year 1936-37, Australian chilled exports represented about 23 per cent. of its total quarters shipped. "Towards the end of 1933 experimental work had progressed sufficiently to enable the investigators broadly to indicate the conditions to be maintained in each phase of the works treatment and overseas transport, to permit of chilled beef being placed in good condition on the markets of Great Britain. In particular, the investigations had shown that, even with a period of storage equivalent to a relatively short voyage of forty-five days from Queensland to Great Britain, extremely strict attention to cleanliness and certain alterations in existing technique in the meatworks, as well as the use in the ships' holds of atmospheres containing 10 per cent. carbon dioxide, were essential to commercial success. . . . The number of chilled quarters prepared at the Brisbane Abattoir for export to England has exceeded 160,000, and, from the standpoint of absence of microbial spoilage, highly satisfactory results have been obtained."

Technical Difficulties Almost Overcome.

ANOTHER important statement of the Queensland Meat Industry Board in its annual report is that technical difficulties in the preparation of chilled beef and of its transport from Australia to the United Kingdom may now be regarded as almost overcome. "Much, however, remains to be done in the regularity of overseas transport and in production before the trade can be said to have become reorganised on a thoroughly sound commercial basis."

The necessity for all Australian works engaged in the preparation of chilled beef for export overseas to observe fully the conditions of the Council for Scientific and Industrial Research cannot be emphasised too strongly, nor can the procedure be successful without the full interest and co-operation of the men employed on the slaughter-floor and elsewhere in the preparation.

"In varying circumstances, particularly in protracted voyages," continues the report, "it has been found that there can be a marked loss of 'bloom,' or, in other words, an absence of the natural brightness of the beef. The factors influencing the rate of loss of bloom appear to include the initial quality of the animal, the treatment to which it is subjected shortly before slaughter, the rates of loss of weight of the beef during each stage of treatment from slaughter to marketing, and the method of carriage, including stowage on shipboard."

These factors are now the subject of detailed study by the Council for Scientific and Industrial Research. It is likely that the results of certain aspects of these studies will shortly be made available.

The factor of ample resting at the works prior to slaughter merits the closest attention. A series of tests carried out by the Board indicates that this practice is of value in the elimination of "fieryness"—a condition which depreciates seriously the value of Australian chilled beef on English markets. It is essential that all parties concerned in the transfer of cattle from the properties to the meatworks should work with the knowledge that the real value of the animal is determined by the soundness of the carcase when the hide is removed.

Dealing with transport, the Board states that the provision of an adequate and regular shipping service must be regarded as essential during progress in the production stage. This service is necessary to give encouragement and stability to cattle producers. It is inevitable that the transport features of a new trade of such an exacting kind can be handled only by experience and co-operation. The Australian Meat Board, working in conjunction with the Overseas Shipping Representatives' Association, has this matter under consideration with the object of effecting a marked improvement in the coming year.

The marketing of beef cattle in Queensland is largely seasonal. In the export of chilled beef the bulk of supplies is available to the United Kingdom in its summer months, the rate of beef consumption being usually then at its minimum. On the other hand, supplies from Queensland tend to fall off very seriously when the demand in English markets is at its best.

"Further improvement in the status of the beef cattle industry will in the main now depend upon improvements within the production stage, particularly in the spreading of the marketing period more evenly over the year," the Board declares. "Progress, no doubt, will be slow in this stage of the business. Better subdivision and watering of cattle properties in the more favourable regions of the State, together with an intensive investigation of pasture improvement and pasture management, should help materially to fulfil the remaining outstanding requirement in the thorough organisation of the chilled beef trade—an extension of the marketing period of well-finished and well-bred young steers."

The Bush Fire Risk—An Appeal.

FARMERS whose properties are adjacent, even remotely, to State forests who plan to burn off grass lands are advised that the Forestry Department is willing to co-operate with them in the strict control of fires lit for that purpose. A co-operative marshalling of the available man power in the neighbourhood has been planned for keeping fires within proper bounds. A general appeal to the people to exercise the greatest care possible to prevent the accidental starting of fires is considered necessary by officers of the Forest Service. The slightest laxity in the throwing-down of glowing matches on roadsides or in the covering-up of camp fires might result in disaster to country homes, crops, and forests. Severe penalties have been prescribed for the careless use of fire, and forest officers must be notified of any intention to burn off pastures or scrub on land within the vicinity of State forests.

Every summer heavy losses occur in country districts as a result of bush and grass fires. It is hard sometimes to prevent such losses, but by far the greater proportion can be avoided if timely precautions are taken. It is possible, for instance, to organise a bush fire brigade and prepare plans for quenching quickly any outbreak. With the hot weather approaching—especially after the dry spring we are having—the formation of such a voluntary corps of fire fighters is worth the consideration of every local producers' association.

The value of bush fire brigades has been proved amply in other States, and by their well-organised action potentially very serious bush fires have been prevented from devastating a whole countryside.

Banana Rust Thrips Control.

N. E. H. CALDWELL, B.Sc.Agr., Assistant Research Officer.

THE banana rust thrips* has been recognised for a long time as a pest affecting cultivated bananas in Queensland. In the last two decades, however, it has become of increasing importance. During this period there has been very considerable development in the banana growing industry in the southern portions of the State, and certain districts from time to time have been subjected to severe infestations of the pest. In the North the banana rust thrips regularly attains serious proportions; but, owing to the slight development of the industry there, particularly as regards fruit for export to southern States, the losses are much less important than in the South.

Distribution in the State.

There now are practically no major divisions of the banana growing areas of the State in which the banana rust thrips is not known to occur. Nevertheless, plantations in many isolated localities, particularly south of Gympie, still continue to produce rust-free fruit, and in some others, the pest population has been insufficient to cause commercial damage to the fruit. Though the insect appears to be spreading gradually throughout the banana-growing areas of Southern Queensland, there is no doubt that the embargo on transferring planting material from infested plantations to clean areas has been, and will continue to be, a very important check on the spread of the pest.

Present Status of the Pest in Southern Queensland.

Following very serious losses in several districts, notably Gympie, Cooran, Pomona, Beenleigh, and Nerang, in 1931-33, the importance of the pest has gradually declined until in the 1936-37 summer there were very few plantations which suffered appreciable financial loss. This has been due partly to a decreased density of the thrips population, with proportionately less severe rust development, and partly to a marked coincidental reduction in the acreage under bananas in the more important infested districts. The history of the pest in Southern Queensland shows that fluctuations between severe epidemic incidence and comparative insignificance must be expected in normal times. Unfortunately, it is not possible to predict the probable rust incidence in any season; but it seems not unreasonable to suppose that the next few seasons may witness another severe outbreak.

Nature of the Injury.

Rust is the common name given to the red or reddish brown discolouration of the skin of the banana fruit (Plate 163) caused by the feeding of both adult and larval banana thrips. This discolouration may be confined to a small area near the points of contact of adjacent fingers, or it may cover the greater part of the surface of each fruit. Usually rust is accompanied to a greater or lesser extent, by surface cracking of the skin. When injury is very severe the rind may split, exposing the flesh of the fruit. The most acute form of rust is due to insect activity during the early stages of bunch development, and it

* *Scirtothrips signipennis* Bagn.

is in association with injury incurred at this time that severe cracking and splitting are most prominent. However, appreciable commercial rust can be caused by insect attacks during the later stages of fruit growth, but, in such cases, anything more than superficial cracking in addition to the discolouration, is rather unusual.

Plate 163.
Injury caused by the Banana Rust Thrips.

Rust of any degree detracts from the appearance of the fruit, though moderate blemishes do not impair its edibility. Severe rust, even without splitting, however, may spoil the flavour, while split fruit has no market value at all. As fruit is bought and sold largely on its appearance, rust blemishes must be kept at an absolute minimum if the grower wishes to avoid the penalties imposed by the trade on "rusty" fruit.

Description of the Insect and Its Life History.

The adult is a slender insect, rather less than one-sixteenth of an inch long, the female being slightly larger than the male. It is golden-yellow in colour with two dark spots on the back towards the anterior end of the body, and a longitudinal dark line down the centre of the back of the posterior half. These dark markings are due to shaded areas on the two pairs of delicate fringed wings, which normally are folded across the back.

The larva is white to yellowish in colour. When first hatched it is approximately one-twenty-fifth of an inch in length, but the mature larva is nearly as long as the adult, and proportionately slightly broader.

The very small egg is laid by the female just beneath the surface of the plant tissue, usually either on the fruit or on the pseudostem in sheltered places beneath the edges of leaf sheaths.

Larvæ and adults may be found on any part of the pseudostem beneath the edges of the leaf sheaths, in the throat of the plant—particularly in and round the funnel leaf—and on the fruit. The larvæ, on becoming mature, enter the soil in which the pupal, or resting stage, is passed. On emerging from the milk-white pupæ, which approximately are the same size as the mature larvæ, the adults make their way back to the plant. Adults are capable of weak flight.

During the warmer months of the year eggs hatch in from seven to ten days, while the larval and pupal stages each last from seven to ten days. Adults may live many weeks. In the colder months the developmental stages are prolonged greatly.

The pest is most abundant during the summer, the peak population being reached between January and April, and the lowest level in July and August.

Insects Liable to be Confused With the Banana Rust Thrips.

There are several other species of small insects commonly found on banana plants, which growers tend to confuse with the banana rust thrips. Another species of thrips* is very like the banana rust thrips, and appears to cause a similar type of injury to banana fruit. It is, however, relatively very scarce; and, moreover, is not known to occur other than in association with the pest species.

Still another species of thrips† is the main cause of confusion to growers. It is found on almost all banana plantations on the "flower" ends of the bunches, frequently in enormous numbers. The male is a pale yellow insect slightly smaller than the banana rust thrips, and does not possess the dark markings of the latter species. It also is noticeably more active. The female is much larger and conspicuously black and red in colour.

The banana silvering thrips‡ is troublesome sometimes in various plantations where the banana rust thrips is known to occur. The injury, however, is quite distinctive, the fruit acquiring a silvery sheen on the exposed surface. Except in a few plantations, this insect is of no great economic importance. As normally it attacks the fruit in spring, both the appearance of the fruit and the time of the year in which the pest is abundant, are excellent diagnostic characters.

No other insects commonly found in banana plantations bear any resemblance to the banana rust thrips, and should not be confused with the pest species.

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* *Physothrips bilongilineatus* Gir.

† *Thrips florum* Schmutz.

‡ *Hercinothrips bicinctus* Bagn.

Selection of Planting Material.

If possible growers should obtain their planting material from plantations where rust is unknown or, failing this, from an area where it is only slight. At all costs heavily-infested plantations should be avoided as a source of supply. Precautions in selecting planting material may obviate or, at least, tend to delay the establishment of the pest in newly-planted areas.

Growers should realise that rust-free does not necessarily mean thrips-free. A small insect population confined to the lower parts of the plants may escape detection even under close examination. Transported to a new plantation and under different seasonal conditions, these insects may be quite sufficient to initiate a severe outbreak of the pest.

Treatment of Planting Material.

Suckers taken from a heavily-infested plantation and pared, and trimmed in an average manner as for banana weevil borer control, are not freed of thrips by treatment in a nicotine sulphate bath (one part of nicotine sulphate to 500 parts of water). The dipping of heavily pared and trimmed suckers may give satisfactory results, but the feasibility of such treatment in practice still requires checking. Nevertheless, paring and trimming, compatible with the commonly accepted standards of safety, do reduce the thrips population on the suckers, and are recommended for this pest as for the banana weevil borer.

For various reasons the use of "bits" as planting material is practised sometimes by banana growers. Theoretically planting material of this type obtained from a thrips-infested plantation is unlikely to harbour these insects. "Bits," therefore, may be of value in establishing new plantations, when the risks of transferring thrips along with the planting material must be minimised, but there is no precise evidence on the point as yet.

Control on Bearing Plantations.

Recent experimental work has shown that the bagging and dusting of the bunch provide a satisfactory economic method of rust control.

The bag must be made of good quality "sugar" hessian, i.e., 11 oz. hessian. Bags 45 inches deep by 27 inches wide are large enough to accommodate normal bunches.

Nicotine dusts give the best results. The nicotine may be present in the dust either as free nicotine or nicotine sulphate, but the actual content of nicotine should be not less than 2 per cent. The physical properties of the dust are most important. A light "fluffy" kind of dust is necessary to secure adequate penetration into all parts of the bunch. Heavy, quick-settling dusts do not give this result. For this reason nicotine dusts, in which some other insecticidal materials such as sulphur have been incorporated, are usually unsatisfactory for the control of the banana rust thrips.

The bunch must be bagged as soon as practicable after emergence from the throat of the plant. The mouth of the bag should be fastened securely round the bunch stalk above the top hand by means of string, wire, or a nail. About a fortnight later the bag should be taken off, fallen bracts emptied out, persistent bracts removed from the bunch, the

"bell" broken off, and the bag then replaced. This operation is necessary to minimise the risk of fungal infection of the fruit.

During the thrips-active season, the dust must be applied to the bagged bunches at fortnightly intervals throughout the life of the bunch, or as an alternative, at weekly intervals for a month after the bunch is thrown, dusting then being discontinued. The former method has given satisfactory results under all conditions experienced in Southern Queensland in the last four seasons. The second has been tried for only one season under conditions of moderate rust incidence, when it was completely satisfactory, and this treatment may, for all practical purposes, prove to be as efficacious as the first.

The first dusting is applied either before or just after the bag is first fitted to the bunch. In the former case both the bunch and the bunch stalk above the top hand can be dusted thoroughly. Quite good results, however, can be obtained by applying the initial dusting through a small hole in the bottom of the bag. All subsequent dustings are given through this aperture. When dusting in this manner, care should be taken to ensure that, by pointing the mouth of the duster more or less directly upwards, the dust is blown right through the bunch from bottom to top.

In all readily available makes of dust gun it is necessary to reduce very considerably the flow from the machine. Without some modification, dusters are liable to discharge excessive amounts of the insecticide which tend to accumulate on the fruit. This may necessitate cleaning before packing.

With small hand dusters of the plunger pump type holding about one-half pound of dust, the aperture of the hopper outlet is usually three-eighth inches in diameter. The dust flow of these machines can be reduced effectively by inserting into the outlet a cork from which a V-shaped section has been cut so that the area of the aperture is one-eighth that originally provided. About six full strokes of the pump are then sufficient for an average bunch. The ideal to be aimed at is to envelop the bunch within the bag in a cloud of dust without depositing more than a film of dust on the fruit. With care and a little practice growers should have no difficulty in performing this operation in a satisfactory manner.

Two other methods of treatment give a fair measure of control. Though not so efficient in the control of rust as bagging with dusting, they have the merit of much smaller cost, and thus may be useful, under certain conditions. For instance, they might well be worth considering early in the season until the trend of thrips activity becomes quite clear.

In the first of these alternative methods, the bags are dispensed with and the bunch is dusted with a nicotine dust at weekly intervals. Longer intervals between dustings are much less efficient. Treatment must be thorough. The dust must be blown into the bunch from all angles, particular attention being paid to the top hands, where thrips infestation is heaviest, especially if the bunch is at all choked. At the same time the dust residue must be kept down to a minimum.

The second alternative method requires the use of a cloak and the application of a nicotine dust at fortnightly intervals. The cloak—a piece of hessian—is wrapped round the bunch as soon as possible after

it is thrown. Thereafter the procedure is the same as with bagging and dusting, the insecticide being blown on to the bunch from the bottom and exposed side, if any. The cloak must be of the same quality hessian as is used for the bags and large enough to envelop the bunch fairly completely.

It is necessary to stress the fact that open mesh, inferior quality hessian, when used either as bags or cloaks, has not proved satisfactory in banana rust thrips experiments.

Whichever control measure is adopted by the grower, every stool in the plantation should be inspected at weekly intervals, or as near thereto as practicable. Thus, even in the case of bagging with fortnightly dustings, the selection of newly-thrown bunches for bagging and dusting should be carried out each week. If this is not done, some bunches will be nearly a fortnight old before the first treatment, by which time they may have developed a certain amount of rust, and what is more serious, acquired a dangerously large thrips population.

Time for Control Measure Application.

The period in which thrips are sufficiently numerous to cause commercial damage to fruit varies considerably from year to year. Normally, growers should be prepared to start control operations during November, but a close watch should be kept on the situation from early October. When bunches less than a month old show appreciable amounts of rust, or are harbouring a large thrips population, control operations should be started immediately. Treatment should not be deferred until "rusty" fruit is being harvested. When control measures are applied first to newly-thrown bunches, those already hanging should not be neglected. November "dumps" (the name describes the characteristic bunches thrown at that time of the year), though they may remain practically clean for some weeks, are very liable to become rusted rather badly by the time they are harvested, and it is not uncommon for October-thrown bunches to be affected similarly.

Dusting may be terminated safely at the end of April, or perhaps a little earlier in some seasons, but the incidental benefits due to bagging the fruit, and to a somewhat lesser extent from cloaking, are so great that growers, where practicable, should continue covering the bunches right through the winter.

The selection of the right time to start control work will depend on the judgment of the grower. Much time and money can be lost by faulty decisions, and growers therefore should familiarise themselves with the appearance and habits of the pest. The insects in the adult and larval stages, the only stages with which the grower need be concerned, are visible readily to the naked eye, while the results of their work are only too obvious. Finally, it cannot be emphasised too strongly that the appearance of the young bunches in the plantation, and not the cut fruit in the shed, is the key to properly applied control measures.

Cultural Points to be Considered in Rust Control.

It is a well-established fact that "choked" bunches develop rust more severely than well-thrown ones. Further, as the fruit in such bunches is compacted and less accessible to dusts, the efficiency of all

control measures is reduced appreciably. Correct methods of cultivation, suckering and fertilizing, designed to promote vigorous growth and well-thrown, quickly-maturing bunches, therefore, are desirable.

A certain degree of rust control sometimes can be obtained by regulating the time of bunching, so that the majority of bunches are thrown during spring or autumn, when thrips activity is less than in the summer months. Cultural difficulties play a predominant part in any such programme, and probable market conditions also must be considered. Bunches thrown in spring escape rust to a large extent, but are marketed when prices are relatively low. Hence, when a plantation can be relied upon to throw good autumn bunches suckering practices should be arranged so that the bunches are thrown in the autumn. Under these conditions bunch treatment for rust control will be necessary only for the March and early April bunches. Bunches thrown during the autumn, however, should be bagged, irrespective of rust incidence. This treatment will ensure the development of well-filled, good quality fruit (despite the cold winter conditions) which will be ready for cutting in the spring when the market is normally buoyant.

Practical Difficulties Associated With Control Measures.

The most effective of the control measures discussed—the bagging with dusting method of treatment—introduces certain practical difficulties into plantation operations, which can be overcome by a little organisation of labour and materials on the part of the owner.

Some method of distinguishing bunches bagged each week is necessary, and the bags, therefore, should be marked with a different numeral for each week. The numbers should be placed on both sides of the bag, and should be as large as practicable, to facilitate recognition at a distance. The use of Roman notation would reduce printing difficulties. The ordinary blacking used in stencilling should be quite satisfactory.

Such a method of numbering bags will simplify the identification of those bunches which require dusting in any one week. It also will greatly assist in indicating the age of the bunch. In practice, a knowledge of the exact age of the bunch as shown by the number on the bag, and the feel of the fruit through the bag, is quite sufficient for an experienced grower to judge very accurately the state of maturity of the fruit without removing the cover.

Incidental Benefits of Rust Control Measures.

The bagging of banana bunches (and to a lesser extent cloaking) has several very important incidental advantages which must be considered in appraising the value of the recommended rust control measures.

The general quality of the fruit is improved very appreciably under all conditions. The fruit matures more evenly all over the bunch and also "fills out" satisfactorily in spite of cold weather. Sun scald—very prevalent when the plants have been more or less defoliated by leaf diseases—is eliminated completely. Cracking of the mature fruit associated with the first cold snap in the autumn is reduced materially. Damage due to incidental pests such as fruit-eating caterpillars, grasshoppers, birds, 'possums, wallabies, and flying foxes, is eliminated almost

completely. Black pit, a serious disease of the fruit occasionally occurring in cold situations, is also controlled by bagging. Finally, if the bag is left on the bunch after cutting, the fruit is protected thoroughly on its way to the packing shed.

The colour of bagged fruit is rather pale, but this does not prejudice marketing. There is, therefore, no need to remove the bag for the last week or so before cutting the bunch in an endeavour to deepen the colour, a practice which frequently results in severe scalding.

Cost of Control.

The cost of the various control measures admittedly is rather high. Bagging with dusting is estimated to cost rather less than 6d. per bunch for both labour and materials, assuming that a bag will serve for two bunches. Dusting alone will cost in the vicinity of 2d. per bunch. The cost of cloaking and dusting will depend on the price of the material used for cloaks, but should be intermediate between the other two methods.

The cost of the bags is the most expensive item. Growers should take every care to preserve them when not in use by ensuring that they are dried thoroughly and stored in a dry place free from vermin. With these precautions, all bags should last for two bunches, and the majority for three. Labour is the next greatest cost. Expense in this direction can be curtailed by efficient organisation. The cost of the dust is relatively slight, as only small quantities of dust are required, particularly when used in conjunction with bags.

The minimum profit which can be expected from the efficient application of rust control measures is represented by the return obtained for the fruit which would otherwise be unmarketable. The cost of control usually will be amply covered by the enhanced prices for the remainder of the fruit, due to the absence of rust and the improved quality. As the wastage in a bad thrips year may represent from 10 to 50 per cent. of the season's total crop, there is no doubt that rust control will pay handsomely except perhaps under extremely depressed market conditions.

A Word of Caution.

The control measures outlined in this article have been designed for conditions in the southern portion of the State. They have not been tested in North Queensland, where conditions are very different in many respects. Their value in these regions still requires investigation.

WHAT IS GOOD FARMING?

Good farming demands the recognition of three basic principles: judicious economy in time, in labour, and in money. The farmer who can direct these successfully will eventually win through. Good farming makes management in every branch of farm production return a profit, and it also leaves a farm at the end of fifty years in a state of productivity as high as, if not higher than, at the beginning.—*W. Watson, General President, Agricultural Bureau of New South Wales.*

Parasites of the Pig.

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[*First published in Q.A.J., Vol. XLII., Part 2 (August, 1934); revised October, 1937.*]

External Parasites.

THE principal external parasites of the pig include lice and mites, the latter being responsible for mange conditions.

LICE (*Hæmatopinus suis*). (Plate 164.)

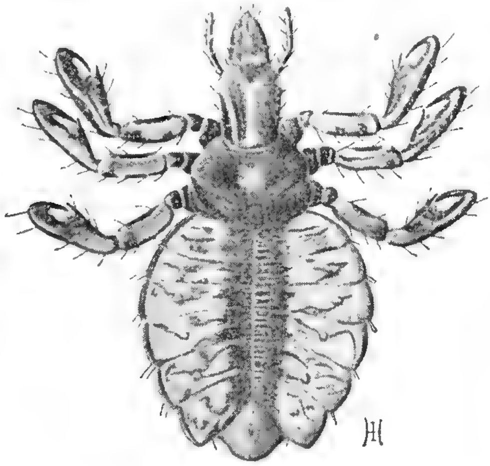

Plate 164.
Pig Louse (*Hæmatopinus suis*). Ten times natural size.

Pig lice, *Hæmatopinus suis,* are found everywhere in Queensland where pigs are reared. The species is one of the largest lice known and may measure up to one-quarter of an inch in length. The male is smaller than the female and may be distinguished readily by the presence of a black streak on the underside of the abdomen. The mouthparts consist of a proboscis or beak with which the louse is able to pierce the skin and suck up blood. This continual puncturing of the skin causes considerable irritation, which in time may lower the vitality of the animal to such a degree as to produce an unthrifty condition and render it more susceptible to attack by other parasites and diseases.

Life History.

Eggs deposited by the females are glued to the bristles of the pig and hatch in from 12 to 20 days, usually in about 14 days. The young louse is very similar in appearance to the adult, differing mainly in size. After hatching, the young lice commence feeding immediately, and after 10 to 12 days become mature. Lice may live as long as 35 days and during her lifetime the female lays about 90 eggs.

MITES.

Two species of mites infest the pig, each of which is responsible for a condition of mange. One species causes Sarcoptic mange, the other, Demodectic mange.

SARCOPTIC MANGE (*Sarcoptes scabiei suis*). (Plate 165.)

Sarcoptic mange or common mange is caused by the mite *Sarcoptes scabiei suis*. This mite is very small, at most only one-fiftieth of an inch long, and whitish in colour. The body is rounded with four pairs of short thick legs, and provided with a number of short backwardly projecting spines on its upper surface. The parasites live in galleries under the skin in which the female lays her eggs. These eggs hatch in 3 to 10 days, and after another 10 or 12 days the young mite becomes sexually mature. There is thus a new generation produced at least every 13 days.

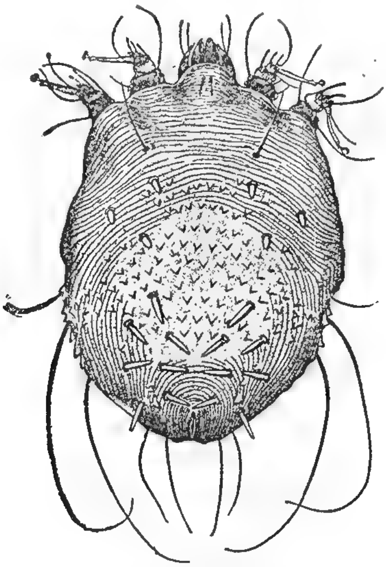

Plate 165.

Sarcoptic Mange Mite—Female. Magnified 100 times.

[*From Farmers' Bulletin* 1085, *United States Department of Agriculture.*

Symptoms of Sarcoptic Mange.

The burrowing of the mites through the skin causes the skin to become inflamed and swollen. At first, these inflamed areas are very minute, but in time they become very conspicuous and, as the mites increase, the lesions gradually coalesce. The irritation causes the animal to rub itself against any convenient object, the areas become raw and bleeding and large scabs are formed. The movements of the pig cause a continual breaking of the scabs, and blood and serum ooze out from the cracks. The bristles on the affected area fall out and eventually none, or only a few, remain. Later the skin becomes hard, thickened, and thrown into folds. In severe cases the animals affected become weak and emaciated and, unless treated, may die.

In the early stages of the disease the lesions occur usually on the head, around the eyes, ears, and nose, and from here the disease spreads along the neck and shoulders until the entire body may be affected.

DEMODECTIC MANGE (*Demodex phylloides*).

This type of mange is caused by a very minute worm-like mite, *Demodex phylloides*, and is much less common than Sarcoptic mange. The mites of Demodectic mange are microscopic in size, measuring only

one one-hundredth of an inch. They spend their entire life in the hair follicles and sweat glands and, when in numbers, cause well-marked lesions. These lesions usually appear first on the snout or around the eyelids, and from there spread slowly over the throat, breast, abdomen, and other parts of the body where the skin is soft and thin. The affected skin becomes reddish and scurfy with numerous small hard nodules. These nodules eventually break and discharge a creamy pus, and many of them may run together to form suppurating cavities.

DIAGNOSIS OF PARASITIC MANGE.

The pig at times may be subject to many varied skin diseases, and for an accurate diagnosis of Sarcoptic or Demodectic mange it is best to submit samples of scrapings from the affected skin for examination. The scrapings, to include the mites, should be taken from the more recent lesions, and should be made deep enough to cause the appearance of blood. The scrapings then should be placed in a tightly-corked tube or bottle and forwarded for examination.

CONTROL OF LICE AND MANGE.

For the control of lice and mange, crude oil or fuel oil will be found satisfactory. The oil may be applied easily by hand, and in view of its adhesive and spreading qualities only comparatively small quantities are required. In the case of lice, a second application is desirable after fifteen days. For severe cases of Sarcoptic mange frequent dressings are necessary; but tests have shown that a complete cure may be expected if careful and persistent treatment is given. Before being treated with the oil, the affected animal should be scrubbed thoroughly with warm soapy water.

No specific cure is known for Demodectic mange, but frequent applications of crude oil check the disease. Animals not responding to treatment should be killed. Animals oiled with crude oil should be kept in the shade as much as possible until the oil has dried, as contact with the sun is likely to cause blistering, especially in the white breeds.

Hog oilers and medicated wallows and dips are recommended frequently as methods of controlling lice and mange. Hog oilers consist of posts wrapped round with oiled ropes or sacking and placed at some convenient spot, the idea being that the pigs will rub themselves against the post so that a small quantity of oil is deposited on or near the area of skin being rubbed. These devices tend to lessen the spread of lice and mange; but, as the pig will rub against any convenient object, are not to be depended upon to effect eradication or prevent the losses caused by heavy infestations.

By taking advantage of the pig's natural tendency to wallow in water, especially during warm weather, the use of crude oil on the surface of the water will be found satisfactory for the control of external parasites. The wallows should be constructed of concrete, and the water, with its film of oil, should be just deep enough to permit the nostrils being kept easily above the surface of the liquid. For pigs of 40 to 80 lb. weight the depth should not exceed three inches, six inches being the maximum for the largest pigs. If the depth is too great the animal will be afraid to lie down. The wallow should be roofed over to prevent the water becoming too hot. The wallow, moreover, should not be kept oiled continuously, but for short periods every ten days, until the desired results are obtained.

Dipping is one of the most effective treatments for lice and mange. For this purpose a concrete bath 40 to 48 inches deep, with a total length of at least seven yards, constructed on the same general principles as a cattle dip should be used. The dip is filled with water, on which crude oil is poured to a depth of four or five inches.

Attention should also be paid to sanitation. As lice will not live for more than three days off the pig, it is not considered that sties which have housed infested pigs would be a source of danger under sanitary conditions. It is always better, however, that such sties should be disinfected and cleaned thoroughly before clean pigs are placed in them.

Mange is highly contagious, and pigs showing symptoms of it should be isolated immediately. Visible lesions of Sarcoptic mange may develop in fourteen to fifteen days; so animals in contact with affected pigs should be isolated for this period. All litter and manure should be cleaned up and burnt and the sties given a thorough disinfection. It should be remembered that Sarcoptic mange is transferable to man; so it is advisable, after handling affected pigs, to bathe and have a complete change of clothing.

Internal Parasites.

No less than seventeen internal parasites or worms affecting the pig have been recorded in Queensland, but fortunately many occur only in small numbers and are not of any economic importance.

FLUKES AND TAPEWORMS.

In Queensland, flukes are unknown in the pig, except for rare instances when the liver fluke of sheep, *Fasciola hepatica,* has been observed in the liver.

The pig does not harbour any species of adult tapeworm but may act as a host for two larval tapeworms which reach maturity in the dog. These larval forms are known as *Cysticercus tenuicollis* and *Echinococcus granulosus.* Only the latter is of importance, as it is the cause of hydatids, which is a serious disease in man.

In the pig, the larval hydatid occurs usually in the liver and lungs, and consists of a bladder of fluid containing numerous minute white specks. Infestation may be prevented by seeing that the pigs are not given access to the fæces of dogs, by boiling all offal thoroughly before feeding it to dogs, and also by the regular treatment of all dogs with an efficient vermifuge to remove the adult worm.

Roundworms.

STOMACH WORMS.

Description and Life History.

Four species of stomach worms are known, of which two species, *Ascarops strongylus* (Plate 166) and *Physocephalus sexalatus,* may be of some importance. Both these worms are whitish in colour, up to seven-eighths of an inch in length, and are found usually at the exit end of the stomach. Their life histories are similar and very interesting, in that the eggs, when passed out in the dung, are eaten by various dung-frequenting beetles. In these intermediate hosts the eggs hatch and the larvæ undergo certain development. The pig can become infested only when it eats the beetle containing the larvæ.

Control.

Control consists in the daily removal of all dung and the clearing up of all litter, &c., which might afford shelter to the beetles. No efficient drug is known which will remove the parasites, but oil of chenopodium, as recommended for *Ascaris lumbricoides*, might be tried.

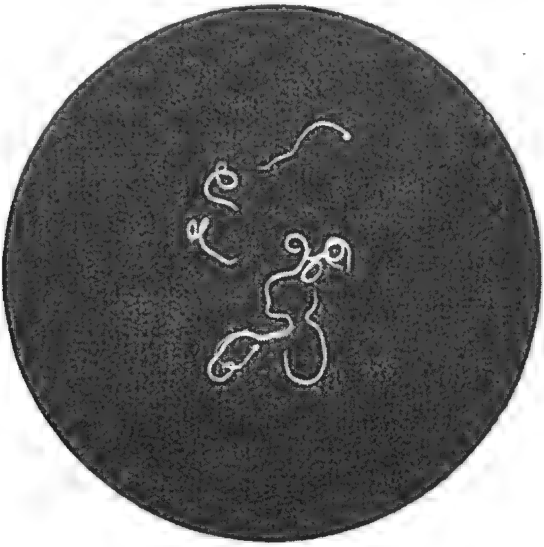

Plate 166.
Stomach Worms (*Ascarops strongylus*). Natural size.

THE LARGE ROUNDWORM (*Ascaris lumbricoides*).

(Plate 167, fig. 1.)

This species is one of the largest roundworms known and may grow up to 15 inches in length. The parasite occurs in the small intestine and frequently in very large numbers.

Life History.

The eggs laid by the female worms pass out in the dung, and under suitable conditions of temperature and moisture become infective in about eighteen days. These infective eggs when swallowed by the pig hatch and set free the young larvæ which bore immediately into the intestinal wall. From there they are carried in the blood stream to the liver, and still continuing their migration reach the blood capillaries, and are moved on to the heart, and from there to the lungs. About ten days after hatching the larvæ leave the lungs, move up the windpipe into the mouth, are swallowed, and reach the small intestine again, in which they settle down and grow to maturity.

Effect on the Pig.

Only young animals up to four and five months of age are affected by the large round worm. The larvæ, burrowing through the liver and lungs, cause serious disorders. Lung destruction may result in a condition of pneumonia, which sometimes may be fatal. A heavy infestation means a stunted and sickly animal, which becomes unprofitable. (Plate 168.) The invasion of the lungs by the migrating larvæ produces occasionally a condition known as "thumps," in which the breathing is laboured and bellows-like. More often, however, destruction of the lung tissue is shown by a short, hard, cough, which is especially prominent after exertion.

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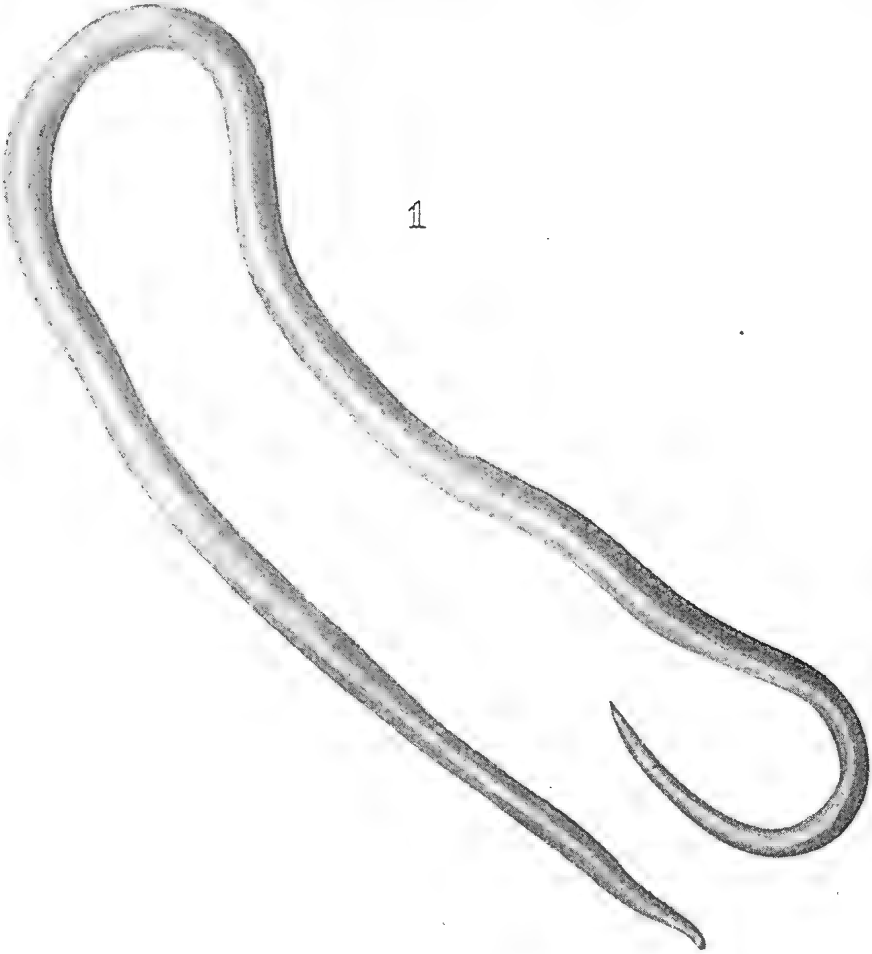

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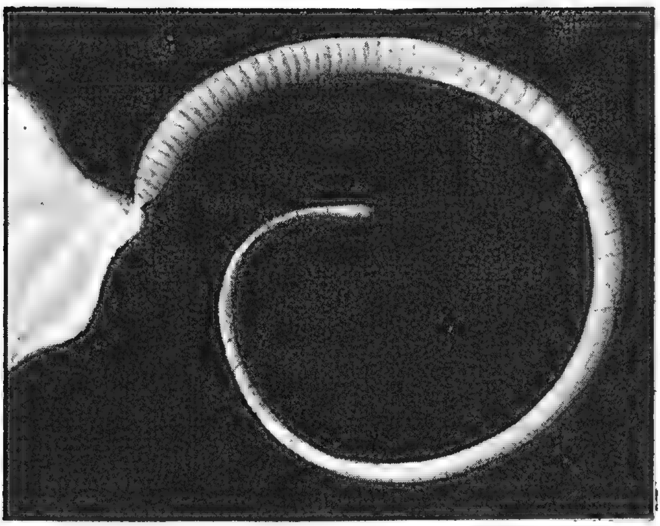


I.W. Helmsing. 1929.

Plate 167.

Fig. 1.—Large Roundworm (*Ascaris lumbricoides*).

Fig. 2.—Thorn-headed Worm (*Macracanthorhynchus hirudinaceus*).

Natural size.

Control.

Treatment of infested animals with oil of chenopodium at the rate of 1 cubic centimetre for every 25 lb. weight will remove the majority of, if not all, the worms from the small intestine. This drug is given with, or is followed immediately by, castor oil, 1 to 4 oz. being used, depending upon the dose of chenopodium administered. Animals over 12 months of age as a rule are not infected to such an extent as to require treatment. The animal to be treated should be starved for twenty-four hours before, and for four hours after, the drug is administered. It is not advisable to treat animals under six weeks old. As one dose of chenopodium cannot be depended upon to remove all the worms from every pig, the dose should be repeated after an interval of ten to fourteen days.

Although oil of chenopodium is highly effective in removing the worms from the small intestine, it is entirely without effect on the larvæ in the liver and lungs, and in order to minimise losses through the presence of this stage in the life cycle, preventive measures must be adopted.

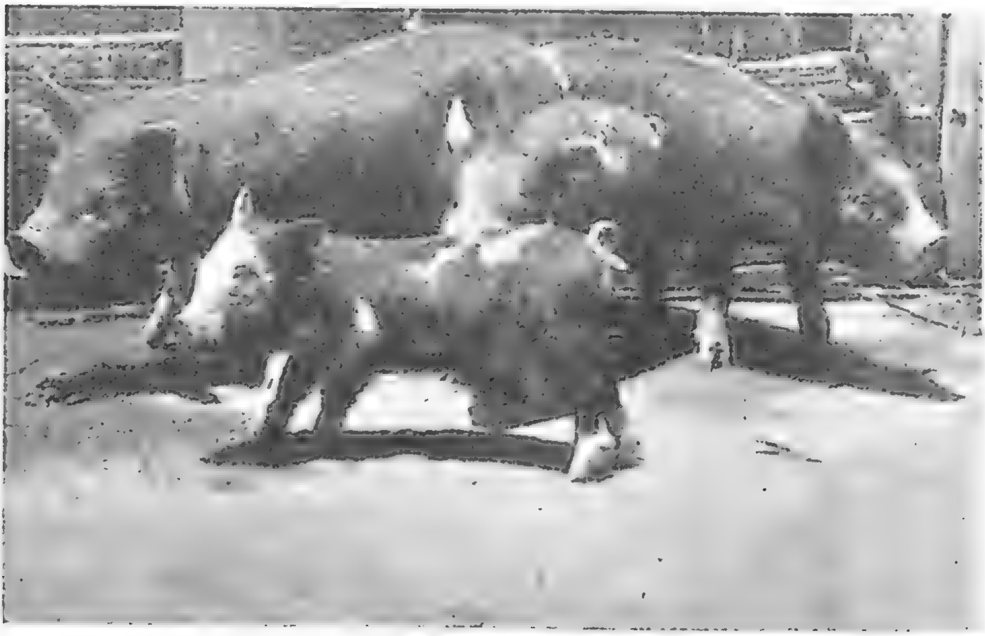


Plate 168.

All these four pigs are from the same litter. The two smaller animals are infested with worms. The two larger animals are worm-free. Note the difference in growth.

During its lifetime the female worm is said to lay as many as 27,000,000 eggs; and as these are very resistant to adverse conditions, the sties and yards become contaminated so heavily with eggs that the animals swallow large numbers of infectious eggs every day. Sanitation therefore is the keynote of prevention. The daily removal of all dung, a good drainage system that keeps the yards and sties as dry as possible, the use of pens with concrete floors, and keeping the animals' food off the ground, are all necessary for the control of this parasite.

A system of pig-rearing in use in the United States has been highly successful in controlling, not only infestation by the large roundworm, but also infestations by other worm parasites. As Ascaris is harmful only to pigs up to four or five months of age, this method aims at keeping the young pigs away from the old contaminated yards till they reach this age. Certain modifications have been made which, it is considered, will make this system more practicable and more effective under Queensland conditions.

Certain of the sties are set aside for farrowing purposes only, and it is essential that these should have concrete floors. A few days before the sow is due to farrow the sty is given a thorough and careful cleansing and finally washed down with liberal applications of a boiling five cent. disinfectant solution. For this purpose any disinfectant with a high tar acid content, 25 per cent. and over, may be used. The solution should be made up, boiled and applied without delay to the floor and walls of the pen.

The sow should be washed with a warm soapy solution, and all dirt and mud crusts removed, particular attention being paid to the feet and udders. She then should be oiled to keep lice worry at a minimum, a second treatment being given after an interval of about fifteen days. In getting her into the prepared pen, she should be hauled and not driven.

After farrowing, the sow and litter are placed either on fresh ground or ground on which pigs have not been running for a number of years. For this purpose three separate pastures are advised. The one to be used by the young pigs should be prepared previously by sowing with a suitable forage crop, and, in order to avoid any wastage of land, the other two pastures could be given over to some profitable farm crop.

The period spent in the pen after farrowing depends on the number of sows farrowing. If only one or two sows are concerned, they and their litters may be placed in the pasture a few days after birth; but a three weeks' period may be necessary so that the young pigs may be strong enough to safeguard themselves against any possible robbing by their older and stronger fellows running in the same pasture. During these three weeks spent with the mother in the pen strict sanitation is necessary.

The young pigs are kept in the pasture till at least four months old. Next year, one of the two other pastures is used for the pigs, thus ensuring that each pasture is without pigs for a period of two years, during which time it is considered that if proper cultivation practices are adopted very little infection, if any, would be left.

In cases where no such pasture land is available, the farmer is advised to remove the top 9 to 12 inches of the old contaminated soil from the yard attached to the farrowing pen and replace it with new, clean soil, preferably sand. Only the young pigs should be allowed to use this yard, the exits from the pen being made too small for the sow to pass through. Strict supervision should be given to the cleanliness of the pen, which every two weeks should be washed down with a boiling 5 per cent. solution of disinfectant.

THE THORN-HEADED WORM (*Macracanthorhynchus hirudinaceus*).

(Plate 167, fig. 2.)

Description and Life History.

The thorn-headed worm is also a large species occurring in the small intestine, the female worms attaining a length of 7 to 16 inches. The parasite is whitish in colour, and its head is provided with an armed proboscis by which the worm attaches itself to the intestinal wall.

The eggs are passed out in the dung, and for the life cycle to be completed must be consumed by certain beetle grubs. The eggs hatch in the intestine of the grub, and the young larvæ forcing their way through the intestinal wall reach the body cavity, where they encyst. The pig, in rooting about, finds the grubs and eats them. The encysted worms are released, attach themselves to the wall of the small intestine of the pig by means of their proboscis, and eventually reach maturity.

Effect on the Pig.

The thorn-headed worm fortunately is not very common, but moderate to heavy infestations sometimes are seen. The worms are moving about continually in the small intestine and reattaching themselves, and consequently severe damage to the intestinal wall is occasioned. The infested animal shows evidence of great pain, may be subject to nervous disorders, and rapidly loses condition.

Control.

There is no drug known that can be depended upon to remove these worms, but the treatment as recommended for the large round worm may lessen the infestation. Strict sanitation must be maintained, and anything that will prevent the pig rooting around and eating the beetle grubs should be considered.

WHIP WORM (*Trichuris trichiura*). (Plate 169.)

This parasite gets its common name from its resemblance to a whip, the anterior portion being thin and thread-like, and the posterior portion comparatively stout. It is found in the caecum or blind gut and adjoining portion of the large intestine, and may measure from 1½ to 2 inches in length.

The eggs laid by the females pass out in the dung, and under suitable conditions of temperature and moisture eventually reach the infective stage. On being swallowed by the pig these infectious eggs hatch, and the young larvæ, making their way to the caecum and large intestine, reach maturity in sixteen to twenty days.

Control.

The whip worm is an exceedingly common species, and a heavy infestation may be distinctly harmful. Repeated treatments with oil of chenopodium may give results; but, owing to its location so far back in the alimentary tract the worm is difficult to reach with vermifuges. The sanitary measures as recommended for Ascaris should be applied for whip worm control.

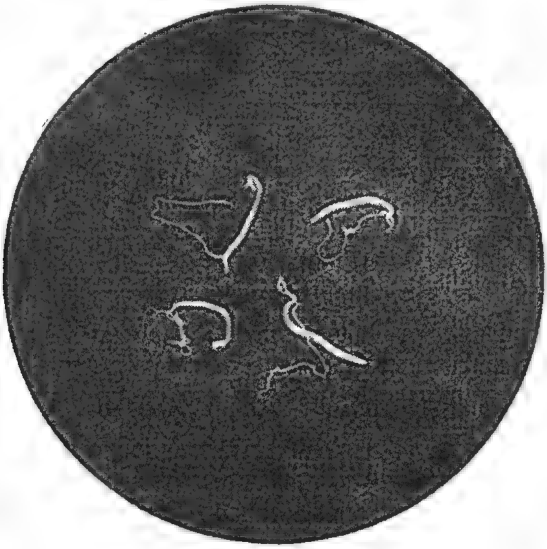


Plate 169.
Whip Worm (*Trichuris trichiura*). Natural size.

NODULE WORMS (*Œsophagostomum* spp.).

Description and Life History.

Two species of nodule worms are liable to infest the pig, namely *Œsophagostomum dentatum* (Plate 170) and *O. longicaudum*, the latter being comparatively rare. Both occur in the large intestine and are whitish or greyish in colour. They may measure up to half an inch in length.

The eggs, in this case, after passing out in the dung, hatch after a few days. The young larvæ feed in the dung for several more days before reaching the infective stage. The larva then is enclosed in a sheath which helps to protect it from adverse conditions. When swallowed by the pig the larva loses its sheath and burrows into the wall of the large intestine, causing the formation of a small nodule. After a period of development, the larva eventually breaks out of the nodule and settles down in the intestine, where it grows to maturity.

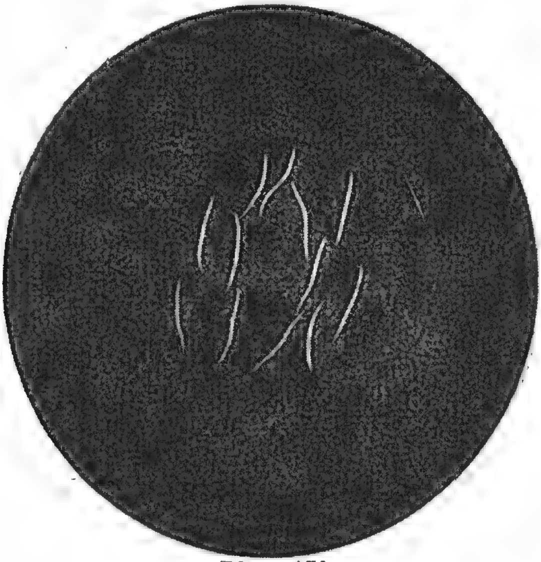


Plate 170.
Nodule Worm (*Œsophagostomum dentatum*). Natural size.

Control.

Nodule worms are most harmful to young stock, and a heavy infestation may result in general unthriftiness. No treatment with drugs is known to be effective for nodule worm, and the only control measures are concerned with sanitation.

LUNG WORMS (*Metastrongylus* spp.).

Description and Life History.

Two species of lung worms are known, *Metastrongylus apri* (Plate 171) and *M. pudendotectus*. Both are long, thread-like worms from 1½ inch to 3 inches long, occurring in the air tubes of the lungs.

The eggs which are laid by the females contain active embryos which are passed out in the dung. Before its development can be completed the larva, after hatching, must be swallowed by an earth worm, the pig becoming infected when it eats the earth worm.

Effect on the Pig.

A light infestation causes no appreciable harm, but when in numbers, and especially in young pigs, the worms may cause a bronchitis characterised by a short, husky cough, and sometimes followed by pneumonia. The infested animals rapidly lose condition and, if bacterial complications arise, may die.

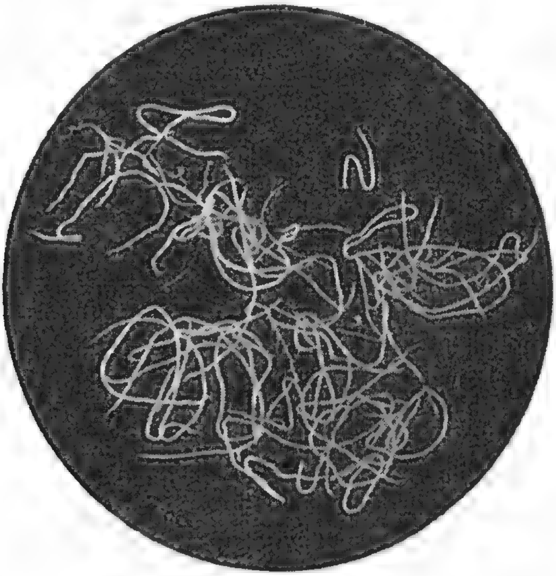


Plate 171.

Lung Worm (*Metastrongylus apri*). Natural size.

Control.

Should an outbreak occur, the unaffected pigs should be removed immediately and the infested animals given good, clean water, nourishing food, and warm quarters. Good nursing is the best treatment for lungworm infestation. All conditions permitting the presence of earth worms must be attended to, and sanitation again is necessary for an efficient control of these parasites.

KIDNEY WORM (*Stephanurus dentatus*). (Plate 172.)

Description.

This parasite is given the popular name of kidney worm because it is found in the vicinity of the kidneys. Mature worms are seen in the flare fat and occasionally in the kidneys themselves, and young stages of the parasite, whilst most prominent in the liver, may occur in the lungs and various other parts of the body. The mature kidney worm has a very distinctive mottled appearance, is relatively stout, and may grow up to two inches in length.

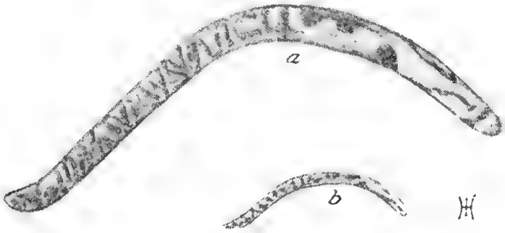


Plate 172.
Kidney Worm (*Stephanurus dentatus*). (*a*) Three times natural size. (*b*) Natural size.

Life History.

Only those females inhabiting the kidneys or kidney fat are sexually mature, and these lay eggs which eventually reach the exterior in the urine. The eggs hatch in one to two days, and five to eight days after hatching the young larvæ are ready to infest the pig. As in the case of the nodule worm, the infective larva is enclosed in a sheath. The pig becomes infected by swallowing these infective larvæ, or infection may occur when the larvæ burrow through the skin. In either case, the young worm eventually reaches the liver, where it remains for some months. After a period of five or six months the worms are mature and, leaving the liver, migrate to the kidney fat, where, if females, they commence to lay eggs.

Effect on the Pig.

Heavy infestations result in an unthrifty animal, owing mainly to the extensive damage to the liver caused by the young worms. The kidney worm is one of the most widespread parasites of the pig in Queensland, and is certainly a cause of serious wastage. The condemnation of pigs' livers and sometimes of infested carcases, and the unthriftiness of infested pigs, is regarded as one of the most serious economic losses the pig industry in Queensland has to contend with.

Control.

Owing to their location in the vicinity of the kidneys, these parasites cannot be removed by drugs given through the mouth, and only preventive measures will bring about a satisfactory control.

As the eggs and larvæ are rapidly killed by sunlight and dryness, yards and sties should be drained thoroughly and kept as dry as possible. All depressions and mud holes, especially those in the shade, should receive attention. Sties should be built of concrete, or else have

slatted floors, which allow the urine to drain through to the ground beneath. All litter should be cleaned up constantly, as the soil so protected forms one of the most favoured sites of the infective larvæ. Yards and sties spelled for six months may be used with safety, as larvæ cannot survive for this period, even under optimum conditions.

The system used for Ascaris control may be applied here with certain modifications. The pastures are prepared as already stated, ploughing and cultivation being very effective in cleaning the land of infection. The food and water troughs in this case, however, are placed on bare, well-drained areas. The food troughs may be shaded, but the surrounding bare areas must be exposed to sunlight as much as possible. After feeding or drinking, the majority of the urine is passed on this bare exposed land, and the eggs and larvæ are killed rapidly by the sunlight and dryness. Paths used by the pigs throughout the pasture also should be kept bare and well exposed.

SANITATION.

Without sanitation little can be accomplished in the control of any parasite. Even though treatment with a drug may be depended upon to remove all worms, there is little advantage in its use if the animals are able to become reinfested immediately afterwards. So far as the pig is concerned, prevention assumes an especially prominent place in worm parasite control, for there is only one species for which an efficient vermifuge is known. This species is the large roundworm, and even here treatment is of no effect against the more harmful phase in the life cycle—namely, the migrating larva. This point emphasises the need of good sanitation, which, by the elimination of conditions favouring the development of the life-cycle stages spent outside the pig, considerably reduces the chances of infestation. The principles of good sanitation are outlined herewith:—

1. *Sties*—In the construction of a sty the farmer should aim at concrete floors. The initial expenditure may be high, but the result is shown in the ease with which such sties may be kept clean and in the subsequent good health of the pigs. Earthen floors in sties should be abolished entirely as it is impossible to keep them clean and dry.

2. *Dung.*—All dung should be removed daily. The dung carries the eggs of those parasites inhabiting the alimentary canal, and its regular removal and disposal is important. If desired for fertilizing purposes, it should be spread out immediately in the pastures. It must be understood that pastures so treated should not be accessible to the pigs; otherwise the dung should be buried under 1 foot of soil. Pig dung is a favoured breeding medium of the house fly, which, when in numbers, not only becomes an annoyance to the animals, but also plays a very prominent part in the spread of disease. The proper disposal of the dung is important from this aspect also.

3. *Drainage.*—Moisture is a necessary factor for the development of the free living stages of all worm parasites, and in its absence very few of these can survive for any length of time. A good drainage system therefore is an essential for good sanitation, and the progressive pig raiser will see that all depressions are filled

in and that mud holes are not permitted. If wallows are considered necessary, they should be built of concrete and cleaned out and disinfected frequently.

4. *Feeding.*—Food never should be thrown on the ground, but always should be supplied in sanitary food troughs. These are best built of concrete, evenly divided by round iron cross pieces, to prevent the animals lying in them. In yards, such food troughs should be surrounded by a concrete floor raised above the level of the ground and sloping away from the trough. The use of hoppers for dry rations is recommended.

5. The runaways and yards should be kept as free of litter as possible. Accumulations of corn cobs, &c., will protect any infection in the soil beneath from such adverse conditions as sunlight and dryness.

THE ADMINISTRATION OF VERMIFUGES TO PIGS.

It must be remembered that the pig has a peculiarly narrow throat, and great care must be taken when administering drugs. With liquids the danger is somewhat increased, as they are apt to enter the lungs and suffocate the patient. Oil of chenopodium and castor oil, however, may be administered quite safely if the directions given below are followed carefully. The required amounts of the drug and castor oil are measured out and thoroughly mixed. Young animals are set up on their tail and between an assistant's legs, the mouth opened by a spreader or gag, and the vermifuge administered very slowly over the back of the tongue by means of a syringe with a long curved nozzle. *The liquid should be given slowly and ample time allowed for the animal to swallow.* Care should be taken not to force the head up too far.

Animals too big to be handled in this way are best placed in a crate or crush. A leather strap is used to elevate the upper jaw and bring the mouth level with the shoulder tops, the drug then being administered with the syringe in the manner described above. Failing a syringe, an old boot from which the toe has been removed is used occasionally for administering liquids; but with the syringe the work is quicker and each animal is given a full dose.

Oil of chenopodium may also be obtained in capsules. It is not always an easy matter, however, to dose pigs with capsules, and as, in any case, the capsules would have to be followed by castor oil, it is considered that the simultaneous administration of the drug and castor oil is much easier for the operator.

The administration of chenopodium in food is recommended sometimes, but is not considered an effective treatment.

DOCTORING THE CALF.

One of the first signs that a calf is ''out of sorts'' is loss of appetite. When a calf refuses to take its milk give it a dose of castor oil. A tablespoonful of oil is shaken up with a little milk and hot water until an emulsion is formed. The dose is then poured down the calf's throat.

A bottle of castor oil should be kept always in a handy place. Another bottle with marks filed at tablespoonful levels should be kept for administering the dose. After use the bottle should be rinsed first with milk and then two or three times with hot water.

Sown Pastures and Their Management.

C. W. WINDERS, B.Sc.Agr., Assistant Research Officer.

[*Continued from p. 280, Part 4, Vol. XLVIII.—September, 1937.*]

(Part IV.)

Couch Grass (*Cynodon dactylon* Pers.).

Origin and Distribution.—Couch grass is widely spread in Queensland as a pasture plant, as a lawn grass, and as a weed of gardens and cultivations. It is probably native to Australia, but is common also in many other countries. It is highly valued for grazing purposes in the Southern United States of America, where it is known as Bermuda grass, and in India, where the name Doub grass is given to it.

Description.—In habit couch grass is a perennial, low-growing grass which produces slender, creeping runners that may reach a length of several feet and which root at the joints. It possesses, in addition to surface runners, thin, underground, creeping stems. The habit of the grass varies considerably according to the nature of the soil and the climate experienced, but it seldom reaches a height of more than 12 inches. The slender flowering stems terminate in between two and five purplish spikes from 1 to 2 inches in length.

Climatic Requirements.—The chief growing period of couch grass is during the summer months. Growth is retarded by cold weather, and is checked almost entirely by severe frosts, but the plants are seldom killed by cold. The grass is extremely drought resistant, though it is not productive under dry conditions.

Soils.—Couch grass requires a fertile soil for its best development, but will grow on an extremely wide range of soil types, from beach sands to dry, alkali soils. It does best on fertile, light loams, particularly on alluvial flats.

Planting.—Flowering heads are produced in abundance during the warmer months of the year, but the heads shatter badly when the seed is formed, and commercial samples of seed often show a germination percentage of less than 30. Good seed, germinating as high as 92 per cent., is available at times, and should be used in preference to cheap, unreliable lines. From 5 to 8 lb. of good seed are sufficient to sow an acre. For planting small areas it is usually preferable to employ rootstock or stem cuttings if they are available, spacing them 18 inches apart in drills struck out at intervals of about 2 ft. Sowing or planting should be carried out during spring or summer.

Owing to its smothering action on most other pasture plants, couch grass is usually not employed in pasture mixtures, but sowings of the grass may be improved by the addition of a suitable legume. In coastal districts the common lespedeza (*Lespedeza striata*) mixes well with couch grass.

Management.—Couch grass pastures are fairly easy to manage, as they are not readily eaten out by stock. However, intermittent grazing is recommended in order to make the most efficient use of the pasture.

Conservation.—Owing to its relatively short growth, couch grass is seldom cut for hay or ensilage.

Feeding Value.—The feeding value of couch grass, particularly when growing on good quality soils, is excellent, and the palatability and digestibility of the grass render it a first-class grazing plant for all classes of stock.

Special Uses.—In addition to its usefulness as a pasture, couch grass may be employed for the fixation of sandy soils or of slopes subject to erosion, and also for green formation on aerodromes, lawns, golf links, &c.

Undesirable Features.—By virtue of its persistent habit couch grass is very troublesome when it invades cultivation areas.

Blue Couch Grass (*Digitaria didactyla* Willd.).

Origin and Distribution.—Believed to be a native of Queensland, blue couch grass is little known outside the State. It is most prominent in the coastal section south of Gladstone, where it has established itself on large areas of cleared or ringbarked forest country.

Description.—Blue couch grass closely resembles the ordinary couch grass in habit, having slender, creeping stems and fine leaves. The seedhead is somewhat smaller and has fewer rays than that of couch grass. The foliage has a bluish tinge.

Climatic Requirements.—The climatic conditions of the South Coast and North Coast districts are best suited to blue couch grass. Its main growth is made during the summer months, and the plant is dormant in the winter. Though it produces well on dry soils in normal seasons, blue couch grass is not particularly drought resistant, and suffers more from dry conditions than does the ordinary couch grass. It is also more susceptible to damage by frosts.

Soils.—Whilst it produces a large bulk of feed on rich soils, blue couch grass is most usefully employed on dry, shallow soils on which grasses of higher value will not thrive.

Planting.—Though the natural spread of blue couch grass must be effected to a large extent by means of seed, the percentage of viable seed in samples collected for examination has been low, and as a consequence seed is unobtainable commercially. Little difficulty is experienced in getting pieces of the runners to strike if planted in wet weather during the warm months of the year.

Management.—The areas devoted to blue couch grass on dairy farms generally are the large paddocks of second-class country unsuitable for the better quality cultivated pasture grasses, and intensive management of these poorly subdivided areas is unwarranted in most instances. Whilst the grass is able to withstand poorly controlled grazing, where subdivisional fences exist some form of intermittent grazing should be practised.

Conservation.—Owing to the difficulty of cutting the matted growth made by blue couch grass on fertile soils, and to the fairly sparse stand on inferior soil types, no conservation of surplus grass is undertaken.

Feeding Value.—The palatability and feeding value of blue couch grass are quite good, though cream production is lower on blue couch grass pastures than on paspalum pastures.

Seed Production.—Collection of seed of this grass is not carried out in Queensland owing to the low percentage of viable seed set.

Pests and Diseases.—Except under lawn or green conditions, pests and diseases are of little importance to blue couch grass.

Special Uses.—Blue couch is widely used for lawns and greens, and where the moisture supply can be kept up in dry weather and heavy frosts are not frequent the grass is admirably suited to these purposes.

Undesirable Features.—The grass shows a tendency to invade paspalum pastures and supplant the paspalum in certain situations. The effect probably is due to soil fertility conditions, and an improvement in soil fertility is indicated if the paspalum is to be retained.

Water Couch Grass (*Paspalum distichum* L.).

Origin and Distribution.—Though water couch is common in many warm countries, particularly in the Americas, and is fairly widespread in wet, tropical and sub-tropical parts of Australia, there is some doubt as to the original home of the grass. If not native to Australia, it certainly has been naturalised for a great many years.

Description.—Water couch is a perennial grass which creeps by means of fairly slender stems that usually root at the nodes. The ends of the otherwise prostrate stems turn upwards, and it is at these extremities that the leaves are most dense. The seed-stalks also are produced from the stem tips. The seed-head is made up of two spikes of small, flat "seeds."

Climatic Requirements.—A moist, warm climate is favoured by the grass, and consequently it is found most commonly along the coastal strip. It is mainly a summer grower, and is cut back by frosts. Extremely heavy or frequent frosts often destroy the grass.

Soils.—Soils abundantly supplied with moisture are essential for the full development of water couch.

Planting.—Seed of water couch is not obtainable on the market, and the grass is propagated by planting pieces of the creeping stems. These strike very readily if planted during the warm months, and spread quickly.

Management.—Because of its habit of rooting freely at the stem joints, water couch is well able to withstand heavy grazing, but intermittent grazing should be practised.

Conservation.—On the coast it is extremely difficult to make a green hay from this succulent grass, but in drier localities a rough-looking hay may be conserved.

Feeding Value.—Whilst the feeding value of water couch grass is fairly good, more particularly for fattening purposes than for milk production, the grass is not a specially good fodder.

Seed Production.—Though a certain amount of viable seed is set, owing to the difficulty of collecting the seed and to the ease with which propagation by means of cuttings may be effected no seed collection is undertaken.

Pests and Diseases.—Water couch is susceptible to attack by the paspalum ergot fungus.

Special Uses.—The grass is a very effective soil binder in damp places.

Undesirable Features.—Whilst useful in certain situations, water couch is a pest under certain circumstances. Once it has invaded a cultivation paddock it is extremely difficult to eradicate, and its presence in bore drains, irrigation channels, &c., is also undesirable.

Buffalo Grass (*Stenotaphrum secundatum* O.K.).

Origin and Distribution.—Though native to the coastal districts of the warm regions of America, buffalo grass is now naturalised in similar areas all over the world. It is quite common in coastal Queensland, either distributed naturally or as a relic of earlier sowings.

Plate 173.
Buffalo grass on an eroded bank.

Description.—Buffalo grass (Plate 173) is provided with surface runners that root and shoot at the joints, and also has underground stems. It spreads freely in all directions, and the runners produce coarse, erect leaves up to 12 inches in length. The seedhead consists of a broad, flat stem with a number of closely appressed flowers scattered over it. The grass forms a very cushiony mat.

Climatic Requirements.—For pasture purposes buffalo grass is of use only in coastal districts. It is chiefly a summer grower, but thrives in shady situations as well as in sunny positions. It is moderately drought resistant, and will withstand a certain amount of frost.

Soils.—A wide variety of soil types will support buffalo grass. It is common on sandy country close to sea beaches, and does well on heavy clay soils. It does not require a high measure of soil fertility for its existence.

Planting.—Seed is formed very sparingly, and stem cuttings are used for propagating the grass. The best time to set these out is in the spring.

Management.—The growth produced by buffalo grass should be utilised at an early stage, since the older growth is of inferior feeding value. Occasional harrowings should be made in order to renovate the turf.

Conservation.—The mat produced is too dense to permit of the grass being mown for hay or silage.

Feeding Value.—Young, leafy growth of buffalo grass has a fair feeding value, but fibre increases rapidly with age.

Seed Production.—Collection of seed is not carried out.

Digitaria Species (Woolly Finger Grass, &c.).

Origin and Distribution.—Woolly Finger grass and related grasses (Plates 174 and 175) are natives of Africa. The whole group has been intensively studied for some years by the South African Department of Agriculture, and over 150 types have been recognised. Several of these have been introduced to Queensland for trial purposes, and numerous farmers and pastoralists have laid down small observation plots. Results to date suggest that some varieties may prove useful in various parts of the State.

Plate 174.
Digitaria Pentzii (Woolly Finger Grass).

Description.—Wide differences in the structure and habit of growth of the numerous types of *Digitaria* exist, and have been classified by research workers. Practically all are creeping grasses, but some form a large tuft before sending out runners; others send out runners (occasionally resembling flower stems) as soon as the plant begins to grow; some form underground as well as surface creeping stems; and various other

types exist. The leaves and runners vary a good deal, as does the seed-head, though the latter is always of the hand-like type. The following descriptions of the most promising forms in Queensland are taken from "The Grasses of Southern Rhodesia," by S. M. Stent and J. M. Rattray:—

Digitaria Pentzii.—This is a shallowly rooted, tufted perennial that sends out fairly long rooting and shooting runners. These runners are very characteristic of this species; the internodes are short, seldom more than 3 inches long, and dense fascicles of shoots are developed from each node, which, if it is able to reach the ground, roots firmly, early establishing a new plant, the internodes soon dying off. The sheaths, especially the basal, and sometimes the leaves, are softly to densely hairy. The Vryburg form is the famous "Woolly Finger grass."

Digitaria seriata or Digitaria Polevansii.—This is a perennial with tall and somewhat bulbous culms (stems), covered with short, densely and softly hairy cataphylls (scales) at the base and springing serially from short, creeping rhizomes. The long, stout surface runners have internodes up to 8 inches long. In its natural state the bare culms and wiry stolons, with long internodes, do not suggest a promising pasture grass, but in Pretoria, where it has been brought under cultivation, excellent results have been obtained with it in this capacity.

Digitaria milanjiana.—This is a very blue grass, with the same creeping rhizomes as *D. Polevansii,* but with the addition of long surface runners with long, reddish internodes and rooting nodes. The long surface runners do not root or form fresh plants as readily as *D. Pentzii.*

Plate 175.
Digitaria valida. (an African Finger Grass).

Digitaria valida.—This is somewhat similar to *D. Pentzii,* but is taller and coarser and has stouter rhizomes. The leaves are short and broad.

Climatic Requirements.—Some of the *Digitaria* types occur naturally in areas of low rainfall, and others in high rainfall regions. All are summer growers. *D. Pentzii* and *D. valida* are reported to give best results in South Africa under a rainfall of 20 to 30 inches per annum; *D. Polevansii* is useful in semi-arid areas, while *D. milanjiana* comes from an arid region. A South African classification of types shows that the high rainfall types have the growing eyes deep under the ground, and the basal shoots are usually brown, hard, and long.

Soils.—In South Africa *D. Pentzii* is said to do best on red loam soils, but can be grown on practically any well-drained soils. *D. Polevansii* prefers sandy soils; *D. valida* thrives on red and shaly soils. The sandy soil types have been shown to possess "swollen nodes and bulbous growing eyes under the soil, whereas those which grow on hard soils have the growing eyes flat against the closely compacted basal shoot."

Planting.—Though most types flower fairly freely, the amount of seed set is very variable. No data are available for Queensland-grown seed, but it is reported that in South Africa the percentage of florets which set seed varies from 0 to 80. Seed has not been collected in any quantity in Queensland, and propagation is carried out by planting rooted pieces of the large tufts or plantlets which are developed at the joints of the runners. The best method of planting these has been described in an earlier section dealing with "Methods of Planting and Covering."

Management.—The pasture types of *Digitaria* are especially resistant to heavy stocking and close grazing, and have good recuperative powers. Intermittent grazing should, however, be practised.

Conservation.—Certain strains are reputed to be suitable for hay-making, but no tests have been made in Queensland. The forms under trial in this State make a dense growth, but can be mown fairly readily.

Feeding Value.—The palatability of most forms is high and the feeding value of young growth quite good.

Seed Production.—As already stated, seed is set in too small a quantity to warrant collection for sowing purposes.

Pests and Diseases.—Though minor pests and diseases cause slight damage in some instances, no serious effect has yet been observed.

Special Uses.—All the *Digitarias*, but more particularly the forms with both underground and surface runners, are effective soil-binders.

Undesirable Features.—The underground stems, which are largely responsible for the persistency of the main types of *Digitaria* under grazing conditions, render eradication of the grasses difficult; consequently the *Digitarias* should not be sown on areas likely to be required later for cropping nor adjacent to cultivation areas.

African Star Grass (*Cynodon plectostachyum* Pilger).

Origin and Distribution.—A native of East Africa, where it is an important grazing grass, this star grass has been introduced with some success to other parts of Africa, and a few years ago was brought to Queensland. Exploratory trials have shown the grass to hold some promise for coastal conditions at least.

Description.—African star grass (Plate 176) is a close relative of the ordinary couch grass, and, like the latter, is a perennial grass spreading by means of runners that root at the joints. There is little or no development of underground runners. Erect or straggling leafy stems are produced from the prostrate runners and form a dense mass of leafy material up to 2 feet in depth. The leaves and younger stems are soft and succulent. The seedheads resemble those of the ordinary couch grass, except that there are generally two whorls of radiating spikes instead of one.

Plate 176.
African Star Grass.

Climatic Requirements.—The grass is mainly a summer grower, and in Queensland has shown promise in areas experiencing between 25 and 60 inches of rainfall per annum. Whilst its drought resistance appears to be moderately high, it is extremely susceptible to frost injury.

Soils.—Fertile loams, including the heavy loams, appear to be the favoured soil types. On light soils growth is less vigorous.

Planting.—Seed is not produced very freely, and the percentage of viable seed is low. In plantings which have been made in Queensland stem cuttings have almost invariably been used. These are best planted in moist land in early summer, the short pieces of stems with roots at the joints being planted in furrows and firmed by tramping.

Management.—Intermittent grazing should be practised. Under dry conditions recovery after grazing or cutting is slow, though where rainfall conditions are satisfactory the intervals between grazings need only be short.

Conservation.—The soft, succulent growth of African star grass is reputed to make a good hay if properly cured, but African experience indicates that a long curing period and frequent turning are necessary to produce a quality hay.

Feeding Value.—Chemical analyses of the grass have shown it to contain a very large proportion of nutrients, and there is no doubt that the grass is of high feeding value. Its palatability to all classes of stock is excellent.

Seed Production.—To date the grass has been established in Queensland by means of vegetative material, and it is unlikely that work aimed at improvement of seed production will be undertaken here for some little time.

Special Uses.—Its creeping and mat-forming habit gives the grass some value as a soil binder.

Undesirable Features.—As is the case with all vigorous grasses, there is some danger of African star grass becoming a pest of cultivation areas. Its aggressiveness and persistency are, however, such that it is not likely to rank with couch grass or kikuyu grass as an almost uneradicable weed.

Plate 177.
Buffel grass.

Buffel Grass (*Cenchrus ciliaris* L.).

Origin and Distribution.—Buffel grass occurs naturally in various forms in tropical and sub-tropical portions of Africa and Southern Asia. It was introduced from India to North-western Australia in 1915, and both African and Asiatic strains have been tested in the various States of the Commonwealth. The grass is still more or less in the testing stage, and further information, particularly with regard to the probable detrimental effect of its burrs on wool, is required before it can be recommended for planting.

Description.—The several forms of buffel grass show a great variation in growth habits, but most are perennial in nature and spread by

means of underground runners. Usually the subterranean stems are fairly short, but a large number of erect shoots is produced. (Plate 177.) The leaves are often rather harsh and hairy, especially in the leafier types. The seedheads, which are of a fox-tail shape, are borne on rather short stems, and the large "seeds" bear a number of bristles, particularly at their bases.

Climatic Requirements.—Buffel grass is a summer-growing grass, and is best adapted to summer rainfall districts. Provided the rainfall is fairly reliable, buffel grass is suited to areas with as low an average annual rainfall as 20 inches. The grass is very drought-resistant, but the leaf growth is damaged by frosts.

Soils.—Well-drained and fairly dry soils of a sandy or loamy nature are preferred by the grass. In clay soils the extension of the underground runners is checked to some extent.

Planting.—Seed was at one time available on the market, but the demand was too small to warrant seed collection on a commercial scale. Germination tests of hand-stripped seed have shown a percentage germination of about 50. Little information is available as to the capacity of the plant to establish from seed. The underground stems are very hardy, and the grass may be propagated by planting small pieces in the spring or summer. Establishment is, however, not particularly ready.

Management.—Buffel grass is well able to withstand heavy grazing and cutting, but sufficient interval between defoliations must be allowed for recovery.

Conservation.—Certain of the strains are of a useful hay type, and two or three cuttings may be made in a season. The quality of the hay is reputed to be excellent. In India the grass has been dried artificially, with the production of a good-quality feed.

Feeding Value.—Some observers report the grass to be unpalatable when green, and avoided by stock. In other instances stock have taken quite readily to the young grass. A good deal may depend upon strain and on soil type. The feeding value of the young growth is good, but the dry, stemmy material is of little feed value.

Seed Production.—The ripe seed does not shatter early, and collection by hand-stripping is easy.

Pests and Diseases.—The grass does not appear to be subject to damage by insect or fungus pests, at least in trial plots.

Undesirable Features.—The bristles attached to the "seeds" of the grass might render it of some danger in sheep districts, owing to the difficulty of removing the seeds from the wool.

Tassel Grass (*Chloris distichophylla* Lag.).

Origin and Distribution.—Tassel grass, which is better known in Queensland as frost-resistant or winter-growing Rhodes grass, is a native of South America that has been naturalised in Queensland for many years. Its most common occurrence is as a weed of waste places, but within recent years it has been cultivated to a slight extent for grazing purposes.

Description.—The grass forms dense tufts and has long, broad, succulent leaves (Plate 178). It does not develop the long surface

runners which are characteristic of Rhodes grass. The seedhead is of the finger type, and the number of rays may be as many as forty-five.

Climatic Requirements.—It is reported that the main natural distribution of tassel grass in Queensland is in the Moreton and Wide Bay

Plate 178.
Tassel grass.

districts, and it is in these areas that it is chiefly cultivated. The grass requires a moderate summer rainfall. It frosts much less readily than does Rhodes grass; but its production during the cool months is not high.

Soils.—A fairly fertile soil is necessary for good results.

Planting.—Spring or summer sowing of the seed is desirable, and the grass should be sown down on cultivated land worked to a fine tilth.

Management.—The management of tassel grass pastures is complicated by the fact that the grass contains a fairly high proportion of a prussic-acid-yielding glucoside at certain stages. Since the period at which the grass can be safely grazed has not been determined, care in grazing must be exercised.

Undesirable Features.—Because of the danger of stock-poisoning, it is considered inadvisable to sow tassel grass for grazing purposes, particularly as it has little advantage in other respects over various other grasses.

Cowcane (*Saccharum officinarum* var.).

Origin and Distribution.—Cowcane is a variety of sugar-cane used in Queensland almost exclusively for feeding dairy stock.

Description.—Cowcane is a tall, tufted plant which stools freely and produces numerous erect stems, which vary in size and leafiness according to variety. It is perennial in nature, remaining green throughout its lifetime, which usually extends over several years.

Climatic Requirements.—The climatic conditions required by cowcane are similar to those needed by the ordinary sugar-cane—namely, moist, warm summers and frost-free winters. Varieties of cowcane have been produced which are somewhat resistant to frost injury; but planting in protected localities is recommended. The drought resistance of cowcane is high, and during dry times a small acreage of the crop often suffices to keep stock alive for long periods.

Soils.—Cowcane prefers a deep, rich, well-drained soil, and requires to be planted on cultivated land. Low-lying areas subject to waterlogging are unsuitable.

Planting.—As with sugar-cane, stem cuttings, and not seeds, are used for planting purposes. Each cutting or "set" should have three or four well-developed buds, and the sets are planted in fairly deep furrows 4 feet 6 inches apart, the sets being spaced about 2 feet apart in the furrows. The sets are lightly covered at first, and the furrow gradually filled in as the shoots emerge towards the surface. Cultivation between the rows is essential while the plants are still young. Varieties suitable to the district should be used.

Management.—Cowcane is not suitable for grazing, but should be cut and, if at all old, chaffed before feeding to stock. Over 20 tons per acre at the first cutting may be expected in most instances. The canes should be cut off just below the surface of the soil with a cane knife. After the crop has had its first cutting cultivation between the rows should be carried out to promote a good ratoon growth in the spring.

Feeding Value.—Because of its high fibre content, cowcane is not a good feed for cows in production. Its chief value is as a maintenance feed for stock during the months when good pasture is scarce.

Seed Production.—Cowcane does not set seed.

PERMANENT SUMMER-GROWING LEGUMES.

Lucerne (*Medicago sativa* L.).

Origin and Distribution.—Lucerne is a native of Central Asia which has been cultivated for many centuries, and is now grown in practically every country in the world. It was one of the first crop plants introduced to Australia, and is cultivated extensively in all States both for hay and for grazing.

Description.—The lucerne plant is perennial in habit, and possesses a deeply-penetrating taproot and numerous erect leafy stems rising from a crown. The leaves consist of three leaflets, which vary in shape and size according to variety. The most common type in Australia is the Hunter River type, which is suited to most Australian conditions, and has been found superior to imported types so far tested.

Climatic Requirements.—The Australian type of lucerne is mainly a summer-growing plant, but in mild winters makes appreciable growth. It requires a large quantity of moisture to produce a good crop, but can be cultivated quite successfully in fairly dry areas provided ample supplies of subsoil moisture are available to the deep roots. Where the watertable is not too far below the surface, lucerne is particularly resistant to dry and hot conditions. Its frost resistance is high. Generally speaking, it may be said that lucerne can be grown without irrigation in all the agricultural and dairying districts, and under irrigated conditions is suitable to most parts of the State, provided soil conditions are satisfactory.

Soils.—Lucerne prefers a well-drained, fertile soil of good depth, but will grow with some measure of success on a wide variety of soil types, ranging from light sands to heavy clays. Good drainage is essential. A poorly drained soil may be recognised in many instances by the presence of yellow, brown, orange, or grey mottlings, and where these are found within 2 or 3 feet of the surface the soil is likely to be unsuitable for lucerne-growing. Impermeable clay or rock formations at a shallow depth render a soil unsatisfactory for the crop. For its normal development lucerne requires a soil well supplied with lime, and in heavy rainfall districts it cannot be grown satisfactorily unless the natural acidity of the soils is reduced by the application of lime.

Planting.—The purposes for which lucerne is sown in Queensland include the following:—(*a*) As a cash hay crop; (*b*) as a summer hay crop, followed by winter grazing; (*c*) as a grazing crop; (*d*) as the leguminous element in a mixed pasture. The cultivation of lucerne for hay purposes is the subject of a separate publication of the Department of Agriculture and Stock, and will not be dealt with here.

For whatever purpose sown, lucerne must be laid down on a well-prepared seed-bed. Whether it is freshly cleared scrub or forest land, newly broken-up native or cultivated pasture, or old land being thrown out of wheat, the area must receive a thorough preparation in order to germinate and destroy weeds, to conserve moisture, and to provide a good seed-bed. In most instances a winter cereal should be grown in the year prior to that in which lucerne is to be sown. When the crop is removed in early summer a long period is available for preparation of the land for lucerne. A fine seed-bed should be available for April or May planting. Should earlier planting be prevented by unfavourable rainfall conditions, sowing may be made up to the end of July with some prospects of securing a good stand.

The rate of sowing of lucerne for grazing purposes is lighter than that employed when the crop is sown for hay purposes, since the large-crowned plants developed in a thin stand are more desirable for grazing purposes than the small-crowned, spindly plants formed in a dense hay stand. The quantity of seed sown per acre varies with the district. Lucerne is a crop with a high water requirement, and the rate of sowing should be adjusted in accordance with the expectation of the amount of soil moisture which will be available during the periods when growth is especially required. On soils with a fairly high water-table in the more favoured dairying and grazing districts a sowing rate of 8 lb. per acre should prove satisfactory; on fairly dry soils in the semi-arid districts 2 lb. per acre usually suffices. Intermediate country will sustain stands seeded at the rate of 4-6 lb. per acre.

The seed may be sown broadcast by hand or by a hand-operated broadcasting machine, or distributed by means of a wheat drill, with or without a special lucerne seed attachment. A light harrow should be employed to cover the seed to a depth of about ½-inch, or it may be tramped in lightly by a mob of sheep.

Experiments to ascertain the value of a nurse crop for lucerne in dry districts are at present being conducted by the Department of Agriculture and Stock.

In areas where there is likely to be a deficiency of phosphates in the soil it is advisable to sow ¾-1 cwt. of superphosphate per acre with the seed.

Management.—Continuous grazing of lucerne is detrimental to the stand, and the pasture should be divided into relatively small paddocks, which may be grazed intermittently when the crop is approaching the flowering stage. The first grazing should not take place until the plants are 9 or 10 inches tall. Two or more cultivations of the area should be made each year to break up the surface soil which has been consolidated by tramping.

Care must be taken to prevent losses of livestock due to bloating, which are likely to occur in stock unaccustomed to lucerne being permitted to feed greedily on succulent young growth.

Feeding Value.—The richness of lucerne in proteins and other nutrients is well known to all stock-raisers. To provide a balanced ration the lucerne should be combined with some carbohydrate-rich food, such as grass.

Pests and Diseases.—A disease known as Witches' Broom, Little-leaf, or Bunchy-top, is fairly common in lucerne stands in dry areas, and no remedy has yet been discovered.

Perennial Lespedeza (*Lespedeza sericea* Mig.).

Origin and Distribution.—Within recent years this species of lespedeza, which is native to the Orient, has been cultivated in the United States of America, but has not yet become an important fodder plant. Seed has been available in Australia for a few years, and trial plantings have been made by numerous persons in New South Wales and Queensland. Local experience to date has shown the plant to have some promise for grazing purposes.

Description.—Perennial lespedeza is a long-lived leguminous plant somewhat similar in habit to lucerne—that is, it is a tufted plant with many tillers, which come away from the crown year after year. It reaches a height of 2-4 ft., and abundant small leaves are produced along the erect stems and their branches.

Climatic Requirements.—The plant is chiefly a summer grower, and requires a moderate summer rainfall for its development. Its drought resistance is inferior to that of lucerne, and the usefulness of the plant probably would be restricted to areas experiencing an average annual rainfall of over 30 inches. It does not appear to be greatly damaged by cold, though the late-maturing seed crop is likely to be affected by early frosts.

Soils.—Perennial lespedeza appears to thrive on a variety of soil types, and is worthy of trial on cultivations for rotation and soil-improvement purposes.

Planting.—Sowing of this legume should be carried out in the spring or early summer. The seed may be drilled in or sown broadcast. If drilled, 4-5 lb. of seed per acre will suffice; broadcast sowings require 10-15 lb. of seed per acre. The seed should be only very lightly covered.

Management.—Experimental grazings have shown that stock, especially sheep, are fond of perennial lespedeza. The natural tendency of the plant is to develop woody stems, and if it is to be used for pasture or hay this tendency must be counteracted by grazing or cutting in the immature stages. The stand should not be subjected to close grazing or cutting, as the regrowth comes not from the crown but from the joints of the stubble.

Conservation.—In the United States, perennial lespedeza is used as a hay crop, the first cutting being made before the stems become woody. Little information is available concerning the feeding value of the hay compared with lucerne hay.

Feeding Value.—The young growth is relished by all classes of stock, and has a feeding value of a high order. Woody material is neglected.

Seed Production.—For seed production perennial lespedeza should be cut when the seed is ripe, cured, and threshed. It is advisable to scarify the seed to permit of easier germination.

SHEEP'S BURNET (*Poterium sanguisorba* L.).

Origin and Distribution.—Sheep's Burnet is a native of Europe and Mediterranean Asia, where it is known as Burnet Poterium, Salad Burnet, and Garden Burnet. It is not extensively cultivated for pasture purposes in any part of the world. In New South Wales and in Southern Queensland it has some value as herbage in mixed pastures.

Description.—The plant belongs to the rose family, and is a tufted perennial with a deep tap root. Much-divided leaves are formed at the crown of the plant, and a dense type of leafy plant results. Towards maturity the plant produces small globular flower heads at the extremities of long flowering stalks. The large angular seeds are brown in colour.

Climatic Requirements.—Whilst Sheep's Burnet is mainly a spring and summer grower it produces a certain amount of green feed during

the cooler months, consequently it is most useful where a well-distributed annual rainfall is received. It is, however, able to survive fairly long, dry periods, provided they are not excessively hot. Frosts have little destructive effect on the plant.

Soils.—Sheep's Burnet appears to be able to live on a variety of soil types, but does best on deep loams. It produces quite well, however, on somewhat poor soils.

Planting.—The sowing of Sheep's Burnet in pure stands is not warranted by the general value of the plant, but a small quantity sown in mixtures will add variety to the diet. Three or four pounds of seed per acre are sufficient in mixtures. Commercial seed is usually of good quality.

Management.—Sheep's Burnet withstands heavy grazing, and its inclusion in pasture mixtures involves no modification of intermittent grazing practices. Should the original stand of the plant commence to thin out, seeding might be encouraged.

Feeding Value.—Experience of this plant is somewhat variable in so far as palatability is concerned. At least when growing on poor soils the plant has a somewhat bitter taste, but in mixtures stock keep it grazed down. The plant is not related to the clovers, and has not the high protein content usually associated with leguminous plants. Nevertheless, chemical analyses of the plant in the immature state suggest it to have a fairly high-feeding value.

[TO BE CONTINUED.]

PREPARATION OF SEED-BED FOR PASTURE.

Various types of seed-bed, ranging from uncultivated forest land to the onion-bed type, are employed for sown pastures. The seed-bed provided by partly cleared forest land, even though some form of harrowing has been carried out, is very unsuitable for pasture establishment, the competition of native grasses and undergrowth usually proving too severe for the seedlings of sown pastures. Likewise, established pastures of native or other grasses are not receptive of additional pasture plants unless a disturbed seed-bed is provided, and a temporary check given to the growth of the established plants, by drastic harrowing. The ashes resulting from scrub burns provide quite a good seed-bed for pasture plants.

By far the best seed-bed is that resulting from the efficient tillage of fertile soil. Most of the common pasture plants have small seeds and require a seed-bed of fine tilth, and by compacting the soil close to the surface a seed-bed is provided which is favourable to the fine, early root systems of the pasture plants. The seed-bed should contain ample moisture, and in dry districts, particularly, cultural operations throughout the seed-bed, preparation period should be carried out with due regard to the conservation of moisture. Ploughing well in advance of sowing is desirable, and the land should be allowed to lie in the rough state for a few weeks before further cultivation is undertaken. Heavy tine harrows, or a spring-tooth cultivator, will be required to break down the clods. Subsequent working should aim at destroying weeds and compacting the sub-surface soil, and shallow harrowings will assist to this end. If the land becomes weedy and the surface sets hard, a disc harrow may have to be used to destroy the weeds. Rolling prior to sowing may be desirable in cases where the ordinary cultivation has not sufficed to form a fine seed-bed.

—*C. W. Winders.*

A New Weed in Tropical Queensland.

W. D. FRANCIS, Assistant Government Botanist.

RECENTLY Dr. L. G. Miles, of the Bureau of Tropical Agriculture, South Johnstone, forwarded a weed for identification and report. He stated that it was growing in a clean area, not grassed, at Japoon. It has attained a considerable spread and, from its seeding habits and vigorous growth, Dr. Miles thinks it has potentialities as a serious pest.

Upon examination, the plant was found to be *Hyptis capitata* Jacq., a native of tropical America. E. D. Merrill, in his "Enumeration of Philippine Plants," Vol. 3, p. 416, remarks that this species is established now in the Marianne and Caroline Islands, Formosa, Java, Amboina, and the Philippine Islands. According to Merrill, it was introduced to the East from Mexico.

The principal features of this species are its opposite, toothed leaves, square stems, and flowers in very dense globular heads which are borne on a long stalk. The more persistent parts of the individual flowers which compose these heads are the bell-shaped or tubular calyx, which is three-eighths to half an inch long, including the five narrow lobes or bristles about one-twelfth of an inch long at the top of the calyx. Within the calyx are four minute nutlets, which are black or dark in colour, and measure less than one-sixteenth of an inch long. Plate 179 illustrates a dried specimen of the plant.

As there are four seeds to each calyx or outer fruit-covering, and numerous calyxes in each seeding head, it is clear that this plant is a very prolific seed-producer.

If the underside of the leaves is examined with a lens, numerous scattered dots can be seen. These dots are small oil glands. They are not confined to this species, but are often found on other plants of the same family (*Labiatæ*). The oil contained in these glands often imparts a peculiar odour to the plants.

HEXHAM SCENT.

During the past month the Department has received for report a number of specimens of common winter-growing weeds. Among these is the melilot or Hexham scent, a native of Southern Europe, Northern Africa, and Western Asia, but now spread widely as a weed in many warm temperate and sub-tropical countries. As information is always sought about the fodder value of this plant the following notes may be of interest:—

Hexham scent was "boomed" as a fodder in Australia some years ago under the name of King Island Melilot, but experience in Queensland has been that stock do not take very readily to it, and have to become accustomed to its peculiar odour and flavour. It has the great disadvantage of tainting milk and cream rather badly. It is short-lived, being at its best during the spring months, dying-off at the approach of hot weather towards the end of October or early November. As a fodder plant for Queensland during the winter and spring months it is inferior to some of the annual trefoils and clovers—such as the common burr trefoil and cluster clover.

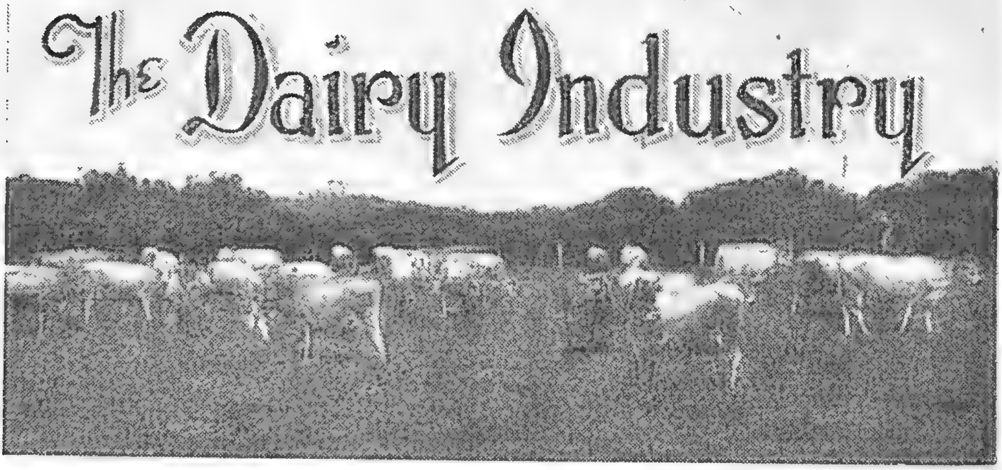
It is a common weed of wheatfields, and if reaped with the wheat and stored for any period the peculiar penetrating odour is communicated to the flour and bread subsequently made. It can be eradicated by ploughing it in, especially in the young stages, when the plant makes a valuable green manure. If cut off near the ground level when it is in flower it will shoot again with numerous short branches, and the cutting will have to be done several times before the root is exhausted. The best time to cut is at the end of the flowering season, just before the seed ripens. In smaller areas hand-pulling or chipping or digging out the weed will prove effective.

—*C. T. White.*

[*Photo. Dept. Agriculture and Stock.*

Plate 179.

Hyptis capitata, a new weed in tropical Queensland. The inset scale measures 1 inch. The photograph is from a dried specimen.



Neutralisation of Cream.

L. A. BURGESS, A.A.C.I., Dairy Research Laboratory.

CREAM obtained from freshly-drawn milk has an acidity of about 0.12 per cent. Such cream can be pasteurised without neutralisation, as there is no danger of coagulation when it is heated. This is done in certain countries where daily deliveries are made to the factories, notable examples being New Zealand and Denmark.

In New Zealand the pasteurised "sweet" cream is churned as such. In Denmark and certain other countries, where the butter reaches the consumer in a comparatively short time, a certain degree of acidity is developed subsequently under carefully controlled conditions before the churning is done.

Where cream deliveries are less frequent the acidity of the cream is seldom less than 0.25 per cent., the actual percentage of acidity depending upon the conditions under which the cream is produced, stored, and transported.

Objects of Neutralisation.

Sour cream cannot be pasteurised satisfactorily, as heating would cause curdling at once. The acidity first must be reduced to a point at which pasteurisation can be accomplished with safety. This process is termed neutralisation, and consists of adding a calculated quantity of a suitable alkali to the cream. Other objects of neutralisation are to avoid the fat losses due to coagulation of the casein on heating, to prevent undesirable flavours resulting from the heating of sour cream, to assist in the removal of objectionable volatile odours, and to improve the keeping quality of the resultant butter.

Choice of Acidity Standard.

The percentage of acidity to remain in the cream after neutralisation is decided by the factory manager, and varies from 0·05 to 0·25 per cent. The average appears to be about 0.12 per cent. for choice cream, which is approximately that of the freshly separated cream. It generally

is a good policy to aim at a higher residual acidity in lower grade cream, as the acidity test applied to such creams generally indicates more than the true acidity owing to the presence of carbon dioxide. Neutralising such cream to a low degree of acidity therefore could result in over-neutralised or alkaline cream.

The important point in neutralisation is to select definite standards of residual acidity for each grade of cream; and to adhere as closely as possible to those standards until good cause for an alteration is shown.

Accuracy is Required.

Accurate neutralisation depends upon the following factors:—

1. The taking of an accurate sample for the acidity test.

2. The performance of an accurate acidity test.

3. An accurate knowledge of the amount of cream to be neutralised.

4. The accurate weighing of the calculated quantity of the chosen neutraliser.

5. The intimate mixing of the neutraliser with the cream before pasteurisation is attempted.

6. The performance of regular check tests on the neutralised and pasteurised cream.

Taking an Accurate Sample.

This is the most important part of any chemical test as *an analysis can be only as accurate as the sample.* It cannot be emphasised too strongly that the sample taken must be representative of the whole of the cream awaiting neutralisation. It definitely is wrong to take the sample before all the cream has been poured into the vat, before the cream has been diluted or standardised, or before the contents of the vat have been mixed thoroughly. The cream should be preheated to a temperature of 90 degrees to 95 Fahr. in order to emulsify the thick cream thoroughly. A discussion of the standardisation of cream will be found later in this article.

Making an Accurate Acidity Test.

The conditions for accurate acidity tests were given in a previous article ("Queensland Agricultural Journal," June, 1937, Vol. 47, pp. 557-562), and for that reason no detailed discussion here is needed.

Measuring the Cream.

For very accurate work it is necessary to know the weight of cream to be neutralised, but this is not usual in practice. An estimation is made by measuring the volume in gallons and assuming that one gallon of cream weighs 10 lb. Strictly speaking, this is not correct, as a gallon of cream weighs a little less than 10 lb., and the weight of cream is therefore over-estimated. This is one reason why it is usual to find that the reduction of acidity has been slightly more than that desired.

To minimise errors each vat should be provided with a dip stick, which is graduated for that particular vat only. It is only by such means that reasonably accurate neutralisation is possible.

Neutralising Compounds.

A large number of alkaline compounds have been used at various times for the purpose of neutralising cream. Among the more common are sodium bicarbonate, sodium sesquicarbonate, modified sodas, soda ash, lime, calcium carbonate, magnesia, and magnesium carbonate. A number of these are much less suitable than others, and will not be considered.

Sodium Bicarbonate, $NaHCO_3$, is a definite chemical compound, and is obtainable in a high state of purity at a comparatively low cost. It does not absorb water readily from the atmosphere, and is non-caustic. Only when used in excess and subjected to prolonged high heating is there any danger of saponification of fat and excessive fat losses in buttermilk. Its only disadvantage is the large amount of carbon dioxide liberated during neutralisation. Its good qualities, however, have made it the most popular neutralising alkali. One part of lactic acid is neutralised by 0.933 parts of sodium bicarbonate.

Modified Sodas are essentially mixtures of sodium bicarbonate and sodium carbonate. They may be mechanical mixtures of the two compounds in definite proportions, or may be definite crystalline compounds formed by crystallisation of a solution which contains both bicarbonate and carbonate. They also are known as "neutral sodas," which definitely is a misnomer. They are somewhat caustic owing to the sodium carbonate which they contain. Because of this, care must be taken to avoid over-neutralisation in order to prevent saponification of fat. When compared with sodium bicarbonate, there is no justification for claiming a reduction of fat losses, as they have the disadvantages of sodium carbonate in a modified degree. They, however, liberate less carbon dioxide than bicarbonate, and therefore cause less frothing. Each of these mixtures has its own degree of alkalinity, depending on the relative proportions of bicarbonate and carbonate, and hence are usually accompanied by special neutralising instructions or charts. They also find a wide use as cleansers.

Sodium Sesquicarbonate, $NaHCO_3$, Na_2CO_3, $2H_2O$, is really one of the modified sodas, but is a definite chemical compound, which does not absorb or lose water or carbon dioxide on exposure to the atmosphere. It is found, naturally, as the mineral Trona in an impure state; but can be manufactured in a high state of purity at a reasonable cost. The amount of carbon dioxide evolved is only two-thirds ($\frac{2}{3}$) of that evolved by sodium bicarbonate. One part of lactic acid is neutralised by 0·837 parts of sodium sesquicarbonate; nine parts being equivalent to ten parts of sodium bicarbonate.

Sodium carbonate is obtainable in a number of different forms.

Soda ash, Na_2CO_3, is anhydrous sodium carbonate, which readily absorbs both water and carbon dioxide from the atmosphere.

Crystal soda or crystal carbonate, Na_2CO_3, H_2O, is a monohydrate of sodium carbonate, which is more stable than soda ash, but which, nevertheless, absorbs both water and carbon dioxide.

Sal soda or washing soda, Na_2CO_3, $10H_2O$, is the decahydrate of sodium carbonate, and loses water, but absorbs carbon dioxide on exposure. This usually is less pure than the other two forms.

Sodium carbonate is distinctly caustic and, while not considered a suitable neutraliser, it finds wide application as a cleanser.

Lime is used to some extent, particularly for highly acid cream. It usually is used as milk of lime (calcium hydrate), and does not cause frothing. The use of lime is much more difficult than the soda compounds, as the strength and quality of lime varies widely, and each batch of milk of lime made up must therefore be tested to determine its neutralising power and must be kept perfectly mixed until it is required no longer. As it is seldom, if ever, used in Queensland it need not be further discussed here.

Calculating the Weight of Neutraliser Required.

A neutralising chart for the use of sodium bicarbonate, giving the weight of bicarbonate required to neutralise from 1,000 to 5,000 lb. of cream by 0.02 to 0.84 per cent. of acidity has been published by the Department of Agriculture and Stock, and is available for distribution to butter factories. If the demand for sodium sesquicarbonate is sufficient, a similar chart for that neutraliser will be prepared. Commercial firms, particularly those selling modified sodas, also issue neutralistion charts for the neutralisers which they sell.

As the charts are liable to become damaged or destroyed it is essential that the operative performing the neutralising should be able to calculate the weight of neutraliser required.

This depends entirely upon the weight of lactic acid which is to neutralised. This can only be obtained from an accurate knowledge of the amount of cream and the acidity percentage. It is best explainable in stages—

(*a*) Calculate the percentage of acidity reduction required by subtracting the desired acidity from the actual acidity percentage.

(*b*) Calculate the weight of lactic acid to be neutralised by multiplying the weight of cream by the percentage of acidity reduction required and dividing by 100.

(*c*) Calculate the weight of neutraliser required by multiplying the weight of lactic acid to be neutralised by the parts of the neutraliser required to neutralise one part of lactic acid.

Example—

3,000 lb. of cream containing 0.40 per cent. acidity is required to be neutralised by sodium bicarbonate to 0.12 per cent. (1 part of lactic acid is neutralised by 0.933 parts of sodium bicarbonate).

(*a*) Percentage of acidity reduction required=0.40—0.12=0.28 per cent.

(*b*) Weight of lactic acid to be neutralised $= \frac{3{,}000 \times 0{\cdot}28}{100} = 8{\cdot}4$ lb.

(*c*) Weight of bicarbonate required = 8.4 x 0.933 = 7.84 lb. or 7 lb. 13½ oz.

If sodium sesquicarbonate is to be used for neutralisation the calculation would be the same for the first two steps; but the third step would be as follows:—(1 part of lactic acid is neutralised by 0.837 parts of sodium sesquicarbonate).

(c) Weight of sesquicarbonate = 8.4 x 0.837 = 7.03 lb. or 7 lb. $0\frac{1}{2}$ oz.

In practice there is no necessity to work out each stage as shown above. The last two stages are combined into one equation.

$$\text{Weight of neutraliser required in lb.} = \frac{\text{Acidity reduction required} \times \text{Weight of cream in lb.}}{100} \times \frac{\text{Parts of neutraliser required to neutralise 1 part of lactic acid}}{}$$

Applied to the above figures the equation becomes

$$\text{Weight of sodium bicarbonate required} = \frac{0{\cdot}28 \times 3000 \times 0{\cdot}933}{100} = 7{\cdot}84 \text{ lb.}$$

or

$$\text{Weight of sodium sesquicarbonate required} = \frac{0{\cdot}28 \times 3000 \times 0{\cdot}837}{100} = 7{\cdot}03 \text{ lb.}$$

The quantity of neutraliser having been calculated, it should be weighed out as accurately as possible. The days of guesswork passed with the practice of neutralising to low acidities, owing to the danger of over-neutralisation.

Mixing the Neutraliser With the Cream.

Having weighed out the required amount of neutraliser, it should be dissolved completely in water, as in this way it is more quickly and evenly distributed throughout the cream. The quantity of water recommended is 2 gallons for each pound of neutraliser.

There are various ways in which the solution of neutraliser may be added, ranging from very crude manual to modern mechanical methods. It should not be mixed in a cream can and dumped bodily into the cream, as this over-neutralises the cream where the neutraliser is added. A water can is sometimes used, and is much better than a cream can. More modern methods consist of spraying the solution into the cream by means of a steam injector, by allowing it to flow from a vessel some height above the vat or by pumping. A recent introduction is a machine which adds a standard strength neutraliser solution at a predetermined rate to the cream as it flows to the pasteuriser. This machine depends for its successful use on the flow of cream being constant throughout the whole pasteurising process. This is not easy of attainment with some pasteurisers, as, after use for some time, the deposit on the pasteuriser interferes with the flow of cream, and over-neutralisation may result. If this machine is being used, frequent acidity tests on the cream from the coolers should be made to see that the neutralisation is being done accurately.

The temperature of the cream when the neutraliser is added should be 90 deg. to 95 deg. Fahr., and it should be kept constantly agitated during the addition, and for some time before pasteurisation is attempted, twenty minutes being a satisfactory period. Unless this time is allowed, the acidity of the cream will not have been reduced sufficiently for efficient pasteurisation.

Performing Check Tests for Acidity.

This is a part of factory routine which frequently is omitted. Check tests on the cream from the coolers is of great value, because it gives the operator immediate information on the accuracy of neutralisation. The butter maker should perform check acidity tests on the cream daily before churning, as this will not only be a check on the accuracy of the neutralisation, but will be of value in deciding the acidity required for the best grading results for each grade of cream. It is dangerous to take everything for granted, and as there are so many factors controlling accurate neutralisation, such check tests serve the purpose of maintaining the keenness of the operator responsible for neutralisation.

Neutralising Standardised Cream.

Cream standardisation, which is merely a process of dilution to a standard percentage of fat, is of value in reducing processed flavours and in controlling the composition of butter. It sometimes is wrongly done after the acidity test has been performed, and difficulty is experienced in obtaining the percentage of residual acidity desired. The addition of water not only reduces the percentage of fat, but also reduces the percentage of acidity, although the weight of fat and acid remains the same. Take for example the following case:—

Weight of cream	3,000 lb.
Fat	40 per cent.
Acidity	0·40 per cent.
Weight of lactic acid	12 lb.
Desired acidity	0.12 per cent.
Acidity reduction required	0.28 per cent.
Lactic acid to be neutralised	8 lb. 6½ oz.
Bicarbonate required	7 lb. 13½ oz.
Weight of residual acid	3 lb. 9½ oz.

If, however, sufficient water is added to reduce the fat to 30 per cent., the figures are as follows:—

Weight of standardised cream	4,000 lb.
Fat	30 per cent.
Acidity	0·30 per cent.
Weight of lactic acid	12 lb.
Desired acidity	0·12 per cent.
Acidity reduction required	0·18 per cent.
Lactic acid to be neutralised	7 lb. 3 oz.
Bicarbonate required	6 lb. 11 oz.
Weight of residual lactic acid	4 lb. 13 oz.

It, however, should be emphasised that when standardisation of cream is performed the acidity desired should be lowered by the proportion of added water.

In the case quoted there was 1,000 lb. of added water in 4,000 lb. of standardised cream, the proportion of added water therefore being 1 in 4 or ¼. The desired acidity should be reduced by ¼ of 0·12—that is, by 0·03 per cent. The acidity aimed at in the standardised cream should

therefore be $0.12 - 0.03 = 0.09$ per cent. The essential figures then would be—

Desired acidity	0·09 per cent.
Acidity reduction required	0·21 per cent.
Lactic acid to be neutralised	8 lb. 6½ oz.
Bicarbonate required	7 lb. 13½ oz.
Weight of residual acid	3 lb. 9½ oz.

It will be noticed that by this method the weight of lactic acid to be neutralised, bicarbonate required, and residual lactic acid is the same as in the non-standardised cream, but that the percentage of residual acidity is lower. It therefore is essential to proceed as follows in order to obtain check tests comparable with the acidity desired:—

1. Standardise the cream to the desired fat percentage and mix thoroughly.

2. Take the sample and perform the acidity test.

3. Aim at a lower residual acidity than is the case when no standardisation is made.

4. Calculate the weight of neutraliser required on the weight and acidity percentage of the standardised cream.

LUNG WORMS IN CATTLE AND SHEEP.

Lung worms in cattle and sheep may become serious during the late winter and spring months. As a rule only the young animals are affected and lung worms should be suspected in any animal showing loss of condition, accompanied by spasms of coughing, signs of suffocation, and scouring. Such symptoms may also be shown by animals which are suffering from a disease of the lungs brought about by some cause other than lung worms. In calves, for example, there is a type of pneumonia caused by bacteria, in which the symptoms are very similar to those associated with lung worm infestation. As the pneumonia due to lung worm infestation and that caused by the bacteria require entirely different treatments, it is always wise to kill an animal in which the disease is far advanced, and examine the lungs. If lung worms are present they will be seen readily, as they occur in bunches in the air tubes of the lungs surrounded by a blood-stained froth.

If the diagnosis is confirmed, the remainder of the animals affected with lung worms should be removed immediately to warm dry quarters and drenched in order to remove other species of worms which might be present in the stomach. This procedure, whilst it does not affect the lung worms directly, increases the animal's resistance to them. Infested animals should be given a good supply of nourishing food, which also assists in building up the animal's strength.

In very severe cases an injection of certain drugs can be made through the windpipe to expel the worms. This operation is not without risk, and in cases where an injection is desirable the assistance of the local stock inspector should be sought.

Further details regarding the drugs to be used for drenching and for injection into the windpipe may be had on application to the Animal Health Station, Yeerongpilly.

—*Dr. F. H. S. Roberts.*

Herd Testing and Profits.

L. A. BURGESS, A.A.C.I., Dairy Research Laboratory.

THE problem facing all dairymen is how to produce the maximum amount of butterfat at the lowest possible cost, while at the same time maintaining, or improving, the fertility and carrying capacity of the pasture and health of the stock. On the farmer rests the responsibility for efficient pasture management; and on the stock that of producing the maximum amount of fat from the food consumed.

All thoughtful farmers must admit that good cows are essential to success. Many claim that they have good cows, and base their claim on factory returns. This, however, is only evidence that the herd as a whole is good, and not that each individual member of it is producing enough fat to pay its way.

A drop in factory returns is unexplainable to such farmers, and they are in a quandary as to where the remedy lies. The farmer who submits his herd regularly to testing can see, by comparing the production records of mothers and daughters, whether the production is being maintained, whether the right cows are being used for breeding, and whether the herd sire is producing profitable or unprofitable daughters. By these means he is able to remedy any possible fault before it affects his factory returns to any noticeable extent.

The productive ability of a cow can be ascertained only by testing. The figures obtained indicate her ability as a producer, under the existing feeding and management conditions, which are controlled by the weather and the farmer. There is ample evidence available to show that the average herd contains animals which do not produce sufficient fat to pay for the food which they consume.

Herd testing is essentially educational. The figures merely disclose the facts, and the responsibility is upon the farmer to carry out the necessary remedies. A farmer who neglects to cull unprofitable animals has only himself to blame if production is stationary or shows a decrease. Failure to act on the part of the farmer cannot be construed, by any means, as a failure of the system of herd testing.

An actual case of well-applied herd testing is as follows:—

Season 1932-33.—A herd of thirty-four cows averaged 194 lb. of fat, total 6,596 lb. At the end of the season no fewer than twenty-six animals were culled.

Season 1933-34.—The herd, reduced to thirty-one members (eight cows retained from previous season, plus five tested pedigree cows and eighteen springers from tested cows), averaged 307 lb. of fat, total 9,517 lb.

Season 1934-35.—The thirty-one cows averaged 340 lb. of fat, total 10,540 lb.

In this case the actual production from the same grazing area rose from 6,596 lb. to 10,540 lb. of fat. The fat per acre thus was nearly doubled, and, with fat at 1s. a lb., the income rose from £330 to £527.

Herd testing will pay handsome dividends, provided that the farmer does his share.

Improving Cream Quality.

J. S. OGILVIE, Dairy Instructor.

ONE point that should be brought home to factory suppliers is that the men supplying inferior cream are taking money actually out of the pockets of the whole of the suppliers, since all inferior cream must have its effect either on butter quality or market conditions. Even if their cream be classed first or second grade, the deduction made by the factory is not adequate always to cover the loss incurred by the extra time and labour which are necessary when the cream has to be treated separately.

In the majority of cases the production of low-grade cream is due to general carelessness in the washing and scalding of dairy utensils, including milking machines—usually exemplified by a quick, cold water wash at night—to the practice of leaving the skim milk alongside the dairy, failure to remove manure from the yards or surroundings, and to untidy conditions generally. Probably 90 per cent. of the inferior cream is due to the causes stated, and the other 10 per cent. is associated with lack of care for the cream after it is separated—such as mixing hot and cold cream, and neglecting to stir the cream regularly, together with seasonal conditions and factors, such as bad water, food, and weed taints.

During the months of November, December, January and February, owing to the extremely humid conditions which characterise most of the dairying districts of Queensland, bacterial development is so rapid that, in order to supply the choicest quality cream, great care is essential. The dairyman's best insurance against the development of an inferior quality is the rapid cooling of the cream below optimum point as a means of retarding bacterial development—that is, to about 70 deg. Fahr., or lower if possible—and the daily delivery of all cream to the factory for manufacture into butter. Under existing climatic conditions, temperature plays such an important part in cream condition that every degree the temperature of the cream can be lowered is an advantage. In this connection it is essential that the cream cooler should be used and that a cream storage room, large enough, and so ventilated as to maintain as low a temperature as possible at all times, should be provided. Many dairies in Queensland fall far short of the ideal, being no more than boxes, and showing (in extreme cases) a temperature inside as high at 115 deg. Fahr. on a hot day. This temperature, maintained for any length of time, could not fail to cause the best cream to deteriorate rapidly.

A large number of yeasty, fermented and other creams with objectionable odours, have been traced to contamination from insanitary pigsties, dirty dairy buildings, and surroundings, skim milk flumes, and skim milk casks outside the buildings which, as often as not, are in an insanitary condition. The use of wooden casks for the storage of skim milk cannot be condemned too strongly. They should be replaced by galvanised iron tanks on a cement floor, as these are cleansed most easily and efficiently after each separation. Under conditions where gravity can be utilised, the use of wide open flumes to carry the milk to the pig pens is much the better method; these, of course, should always be kept clean.

Many dairymen fail to understand what constitutes boiling water. As long as it is "pretty hot" they consider it will do, not worrying about the fact that its temperature is too low to give it germ-killing efficiency. Often, too, there is an inadequate supply of boiling water, due mainly to only one kerosene tin of water having been prepared, which is part mixed with cold water for washing purposes, the balance being used for sterilisation and drying. Inadequate provision also is made for boiling the water. A set-in boiler should be installed. A copper will be found to be more economical in the long run.

Where conditions allow, a direct water supply should be drawn from a tank attached to the dairy house or some other clean source; avoiding, if possible, the use of the milking shed roof as a catchment area, this being a potential source of contamination. Many dairymen consider that one such tank provides an adequate supply of water for dairy purposes all the year round, and make no provision against dry spells. When a dry spell comes, they cart water from creeks and waterholes, often only a few hundred yards distant. Frequently, however, it would be possible, with the expenditure of a few pounds for a pump or windmill, to obtain an ample supply of good fresh water for all purposes for such permanent sources as wells and running streams. The dairy tank should be well protected against the invasion of frogs, birds' droppings, &c.

The dairyman, forgetting that milk and its products are most perishable, too often leaves the washing up of utensils and the care of cream to children or employees, over whose operations he exercises very little or no effective control.

Supplied with the separator is either a tin tube or galvanised iron wire to keep the separator discs together. This leads only to a general swilling of the discs in the water and not the careful washing of each part separately. The result is that the discs are generally left in a greasy, unhygienic state. To ensure thorough cleaning, they should be washed separately and scalded after each separation, and aired in a clean, dry place.

Numerous cases of second-grade cream arise from the use of milking machines, and are due often to infection from the vacuum line, where the old-style plants are in use. These have a large vacuum tank and line, which are very hard to dismantle and clean, and, more often than not, are not cleansed at all. Under such conditions farmers are advised to install the latest type vacuum line and tank. The high price of rubber inflations and tubes causes the dairyman to use them as long as possible, and this fact is responsible for most of his machine taint trouble. Only when he is shown how the rubbers affect the quality does he see the necessity for replacing these. The frequent replacing of these parts usually results in the production of a higher grade cream which offsets easily the money expended.

The inspector, on visiting the dairy, explains his mission, and asks for, and in practically every instance receives, the dairyman's co-operation. Demonstrating with means to hand, he explains how milk and cream can be deteriorated by the hands of the milker, udder and teats of cows, manures, utensils, and general surroundings, and also when awaiting delivery to the factory. In illustrating these points, and

tracing the cause of low-grade cream, the Government Dairy Research Laboratory is proving of great value. Generally speaking, by far the worst cream received at factories comes from dairies where milking machines are in use, and this seems to be due to a want of knowledge, lack of proper care of such machines, and the failure to appreciate the fact that the bacteria associated with milking machines are of a very virulent and active type, which, on entry to the milk during its passage through the machines, are in an actively growing state, particularly where rubbers are kept in plain water. Under ordinary hand-milking conditions these particular bacteria would take twelve or more hours to reach the stage of development that two or three hours would produce in machine cream.

Desirable Conditions.

The percentage of second-grade cream in most Queensland dairying districts would be reduced to a negligible quantity if the following conditions could be fulfilled:—

1. All tin ware, including cream cans, must be tinned thoroughly and have a smooth surface.

2. All utensils, including cream cans, must be sterilised thoroughly with boiling water and cooled before use.

3. A good, clean, pure water supply should be ensured by the use of tanks, windmills, and pumps. As water is an important adjunct, the farmer who has a water supply laid on to the milking shed and dairy conveniently served with taps will be repaid amply for the little extra expense. It must be pointed out, however, that the roof of the milking shed should not be used as a catchment area for water for dairy purposes, owing to the danger of contamination by dust from the yards. Where any doubt exists as to the purity of the water supply, it should be boiled before being used.

4. Ample facilities for boiling water, such as those afforded by a set-in boiler, should be provided as required by the Dairy Produce Acts.

5. The general use, firstly, of cold water for rinsing; secondly, of warm water and washing soda for the first washing; thirdly, of boiling water for proper scalding; and, finally, the draining of all dairy tinware, and the cleaning of the milking plant, should be regarded as essential. Cloths never should be used to dry the inside of dairy utensils. If boiling water is used, they will dry of their own accord, and should be allowed to cool before being used again.

6. Dairymen should have a better general knowledge of milking plants, especially in regard to their cleaning and handling.

7. The use of any utensil, or separator part, whilst it is in a warm state, caused by the sun or hot water, should be avoided.

8. The practice of cooling the cream to as low a temperature as possible; keeping it in cool, clean, well ventilated surroundings, and stirring it frequently and mixing when cool, should be adhered to. Cream should never be allowed to stand in the sun.

9. All cream from dairy to factory should be delivered daily.

Difficult Parturition.

At this time of year, cases of difficult calving are fairly common, and a few hints as to what to do and what not to do may be of value.

When calving becomes imminent, the cow leaves the herd and seeks a quiet spot. There she will become restless—getting up and lying down—and show evident signs of pain.

As labour advances the back is arched, the hindquarters are drooped, and straining becomes violent and continuous. Meanwhile blood may appear on the vulva and tail, and the waterbags protrude between the lips of the vulva. They increase rapidly and the feet of the calf may be seen within them.

The waterbags furnish a soft uniform pressure for the preliminary distention of the womb and passages, and prepare the way for the delivery of the calf. In normal presentations, it is wrong to break these bags prematurely.

When the cow calves standing up, the navel string breaks when the calf falls to the ground; but, when she calves lying down, the string is broken when she rises. A few hours after calving normally, afterpains commence and the placenta or afterbirth is expelled. If this is not expelled within twenty-four hours, it should be removed by careful traction. A good method is to take two sticks about 2 feet long, between which the end of the afterbirth is grasped, and rotated around them until close to the vulva, when gentle traction is applied, from side to side, and backwards and downwards, care being taken not to break it. A vaginal douche of boiled water at blood heat, to which has been added a mild antiseptic, should be given. A cheap and efficient outfit for this purposes consists of about 4 feet of ½-inch rubber hose and an ordinary funnel. The end of the hose should have its edge pared off with a sharp knife, and, after having been smeared with carbolic vaseline, it is introduced into the vagina, and gently pressed forward as far as the womb. The funnel is then placed in the other end of the hose and held above the cow's back, the douche being poured into it.

It is well, at all times, to allow nature to do its work without interference; but, when calving is protracted, and progress is not being made, a careful examination is necessary.

The operator should wear a clean sleeveless shirt, and his arm should be smeared with carbolised vaseline, or an antiseptic oil. This protects the arm from poisoning and the cow from the introduction of infective material into the passage.

The hand should now be introduced into the vagina and a careful examination made. It may be found that (1) the water bags have burst, and that neither the feet nor head of the calf are presented, or that there is a presentation of (2) one fore foot and head; (3) both fore feet, and head back; (4) head with both fore feet back; (5) one hind foot without the other; or (6) other abnormal presentation.

Whatever part is presented should first be secured by a rope with running noose, so that it will not be lost during subsequent manipulation, and may be readily brought into position when the missing parts are found. If the cow is standing, her head should be turned downhill so that the fœtus, and abdominal organs, lie forward to give more room to bring up the missing head or limb. If lying down, she should be turned over on to the side opposite to that on which the limb is missing. When the missing part is located, no attempt should be made to bring it up during a labour pain, but after the pain has ceased an effort should be made to secure it before the next pain comes on.

If pains are continuous and violent, they may be checked by putting a tight surcingle round the body in front of the udder. If it is found that the passages are dry, pure olive oil may be run into the womb through a rubber tube. If the head is back, the limbs which are presented should be first secured with a rope having a running noose, then the fœtus should be pushed as far back as possible and an attempt made to secure the head with a noose or hook, and to bring it up into the passage. Having brought the limbs and head into a suitable position, traction should now be applied in a downward and backward direction, but only when the cow is straining.

Pulling when the cow is not straining should not be attempted. Patience and care are necessary. The practice of attaching a draught horse or motor car to the fœtus and pulling it out by sheer force is not only cruel, but usually results

in the death of both the cow and the calf. After a protracted calving the cow will be exhausted, and she should be provided with a warm rug and bed, also a few bottles of warm gruel.

Points to remember are:—

Do not interfere too soon.

When interference is necessary, exercise patience and take time.

Do not use force until the fore feet and head or the hind feet are secured in position.

Remember to pull only when the cow is straining.

—*W. Dixon, Stock Branch.*

RED-WORMS IN HORSES.

Red-worm disease is one of the most serious diseases of horses in Queensland. The disease is caused by the presence of large numbers of red-worms, which inhabit the first part of the large bowel. Those worms vary in size from about ½ inch to 1½ inches in length and, in a freshly-killed carcase, may be found adhering to the membrane on the inside of the bowel. Their reddish colour is due to the fact that the worms suck blood.

If the worms are numerous, the infested animal does not thrive well, the coat becomes rough, and loss of condition and weakness follow. Diarrhœa is frequently present, and in severe cases the blood becomes thin, the eyes become sunken, the whole appearance of the animal becomes very dejected, and finally death may supervene. The symptoms are gradual in their onset, and the disease may thus be in an advanced stage before it attracts the attention of the owner.

The worms do not multiply within the bowel, and each one of the many thousands that may be present has been picked up as a young worm from the pastures. These young worms in the pastures have arisen from worm eggs which have been passed from the body of the horse in the dung. As these young forms may live among the grass as long as four years, a paddock on which horses are permanently grazed may become heavily infested.

The most efficient drug for the treatment of red-worm disease is oil of chenopodium, which may be most easily administered, after mixing with raw linseed oil, by means of a bottle or a drenching bit. The animal to be treated should be starved for thirty-six hours before, and for four hours after the administration of the drug. The oil of chenopodium is given at the rate of 1½ drams for every 250 lb. live weight in 1 to 2 pints of raw linseed oil. Oil of chenopodium is a highly poisonous drug, and those wishing to use this treatment are advised to get in touch beforehand with the Animal Health Station, Yeerongpilly. In areas possessing a high rainfall, three or four treatments should be given during the year.

In addition to treatment, an attempt should be made to prevent reinfestation. For this purpose, it would be better not to graze horses continually in a single paddock, particularly if it is swampy. Attention should be given to the regular collection of manure from stables and yards. Heavy stocking is not to be recommended, and young horses (up to three years) should, if possible, be kept away from pastures that have been much grazed by horses.

—*Dr. F. H. S. Roberts.*

Winning Pig Exhibits.

E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

KEEN rivalry, a fine progressive spirit, and a marked all-round betterment in type and conformation of the breeding stock shown, were the outstanding features of the 1937 exhibition of stud and commercial pigs at the Brisbane Show.

In most of the classes there was a sufficient number of good animals to give the judges plenty of variety, and some stock of really excellent quality were paraded.

The pens of recently imported pigs (Berkshires and Middle Whites), the property of the Department of Agriculture and Stock, and, for the purpose of comparison, the Canadian Berkshire boar, the property of the Department of Public Instruction, added interest to the show.

PRIZE-WINNING STOCK.

Berkshires always are the centre of interest to those favouring this British breed, for it is well known that they have an adaptability to farm conditions, and can be used for cross-breeding for both the local and export markets.

The champion Berkshire boar, Woodbine Lentonius 5th, shown by Wide Bay Stud Piggery, Gympie, is of the long, roomy, deep-bodied type, full of quality. He is a son of that remarkable sow Lenton Patience (imp.) purchased in England several years ago by Mr. F. Bach, of Oakey.

The Queensland Agricultural College was awarded second prize in the over two year boar class, with Grafton Jock. A variation in type was noted in the much more compact reserve champion boar Kapleton Supreme, shown by O. L. Klein. He won in a class of six in which Goodna Hospital secured the additional award.

The younger boars were of excellent type, and included many prize winners.

Plate 180.

Berkshire Sow and Litter, second prize winning group. The sow, "Wide Bay Zella," won reserve championship. The litter, thirteen in number, were lucky in that all travelled safely from Rockhampton and were in good order at completion of Show.

Championship in the female classes went to F. Bach with Bonvale Jewel 2nd, sired by Woodbine Lentonius. A Wide Bay Stud exhibit won the second prize, and M. Porter and Sons gained third award with Roselock Queen.

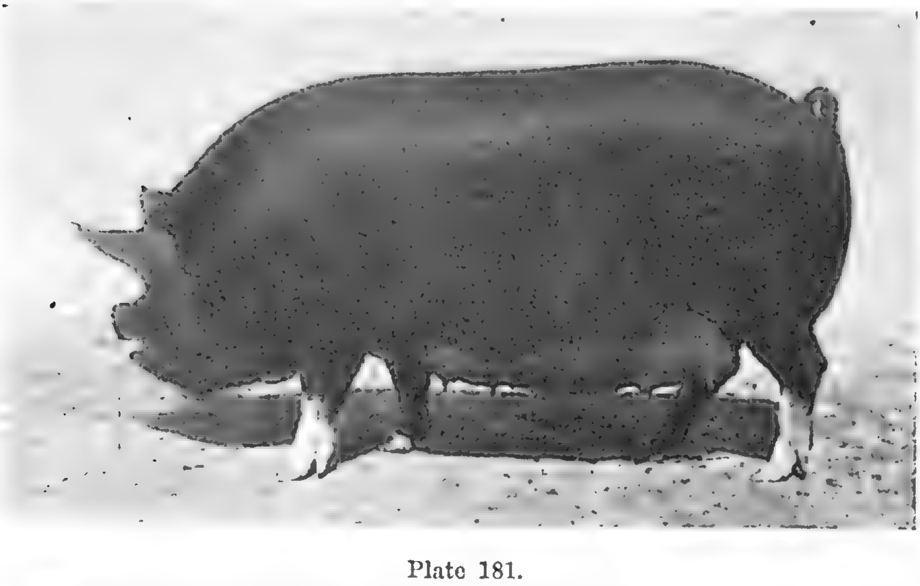


Plate 181.

Reserve Champion Berkshire Sow, "Wide Bay Zella," shown by Mr. A. W. Hodgkinson, of Rockhampton. She is the mother of litter shown in Plate 180.

The reserve champion sow, Wide Bay Zella, shown by A. W. (Jerry) Hodgkinson, with her litter of thirteen, was a winner also in the class for sow and litter in which F. Bach, with Woodbine Amelia and litter, won first award. There were very liberal entries in most of the younger classes, no fewer than sixteen sows being penned in class five months old and under eleven months, and twenty-two in class under five months of age. F. Bach with Thicket Baron 2nd won the boar and progeny prize, and O. L. Klein the breeders' group.

As in the other stud classes, special sashes were presented to the champion winners in each breed by the Australian Stud Pig Breeders' Society, and special ribbons and reserve rosettes by the Royal National Association.

The silver medal presented by the National Pig Breeders' Association of England was awarded to F. Bach's champion sow.

LARGE WHITES.

The total entry of Large Whites was not up to previous years' standard and there was considerable variation of type, nevertheless some excellent quality animals were penned. Some of the senior animals were much too fat and were inclined to be heavy boned in comparison with those selected for premier awards. The champion boar, A. G. Wallace's St. Cloud Bradbury 3rd, was selected from the class under

Plate 182.

First prize Light Baconers. Exhibited by Mr. M. G. Bayliss, of Maleny, a choice quality lot of Large Whites, in ideal condition for factory requirements.

seventeen months of age in which the Queensland Agricultural College had the second award with Gatton Samson 55th. Similarly, the reserve champion came from the class under eleven months, in which J. A. Heading, with Highfields Hardshot 7th, was the successful winner. Mittadale Stud Piggery won second award with Mittadale Sam, and A. G. Wallace third, with Rose Mount Chief. Mr. Wallace won first award in class over two years old with Rose Mount Bradbury 3rd, and J. A. Heading second with Gatton David. Mr. Heading and W. H. Mumford won the awards in the class over seventeen months and under twenty-four months in each with boars of "Highfields" production.

The Large White sow, Staghorn Belle, shown with a large, thrifty litter, by A. G. Wallace, a New South Wales exhibitor, attracted considerable attention, and was a centre of interest throughout show week.

In the female classes, the champion sow was Highfields Pear 29th, shown by M. G. Bayliss. She also secured the special medal presented by National Pig Breeders' Association. The second prize was allotted to Mr. Wallace's Staghorn Belle, which also was shown in the sow and and litter class.

The reserve champion sow was J. A. Heading's Highfields Peg 13th, sired by the former champion Gatton David There were many fine-quality sows in the younger classes.

The boar and progeny prize went to Gatton David and his progeny, shown by Mr. Heading, who was also awarded the trophy for the breeders' group.

MIDDLE WHITES.

In the Middle White male classes the Salvation Army Training Farm, at Riverview, secured the championship with Armagh Hero 1st, a competitor in the class in which H. O. Rees secured second award.

A new exhibitor, J. H. Teague, gained first award with Turo Hivite in the class for boars over seventeen and under twenty-four months. One of T. M. Wallace's boars was placed also in the same class.

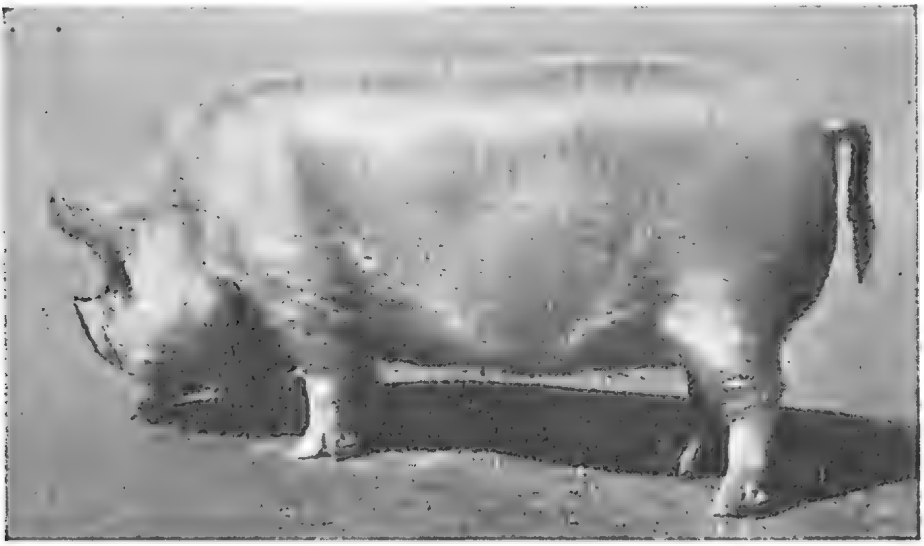


Plate 183.

Mr. J. H. Teague's Champion Middle White Sow, "Turo Boronia 2nd," who secured for her owner a coveted award on the occasion of his first penning an exhibit at the Royal National.

The reserve champion boar was T. M. Wallace's Armagh Peer 3rd. The champion sow was J. H. Teague's Turo Boronia 2nd, the reserve being Gladesville Blossom shown by T. M. Wallace.

The Middle White breed in Queensland has improved greatly in recent years, and it is hoped that the importation of unrelated strains, and the distribution of the progeny of the imported stock, will do much more to assist in building up this breed. Mr. Wallace secured both the boar and progeny prize and the trophy for breeders' group.

TAMWORTHS.

An increasing tendency for Tamworths to become too compact and to carry too much condition for their size and age makes the judging of this breed difficult.

The championship in the male classes was won by M. Moffatt with a grandson of that remarkable old boar, Whittingham Red Start (imp.), a boar whose progeny have realised over £1,000, in addition to producing a very large number of prize winning and useful breeding animals. The reserve champion was Lawn Hill Rex, shown by F. Thomas, a new exhibitor from the Beaudesert district. Wide Bay Stud obtained first award in the class for boar two years and over with South Burnett Starlight. Wollongbar Sunstar, shown by P. V. Campbell, was placed

Plate 184.

Mr. J. Barkle's Champion Tamworth Sow, "Wattledale Lydia Pet," a deep-bodied, roomy matron of modern type.

second. In the class for boars under seventeen months but over eleven months, the boar Wattledale Wonder, shown by Mr. Barkle, secured the award, and was afterwards purchased for a Government Stud in Western Australia. O. L. Klein's exhibit won the second award. Mr. Barkle obtained many of the awards in the younger boar classes, sharing these with Messrs. Campbell, Moffatt, and Champney.

The Tamworth sows and litters were the best seen at any Australian show, an indication that, if properly handled, this breed will continue to maintain its reputation for prolificacy. P. V. Campbell secured first and E. M. Melville second awards, with sows and litters that were hard to beat.

The champion sow, Wattledale Lydia Pet, was a very fine animal, and should develop into a grand breeder as she lengthens out and becomes deeper in body. Mr. Barkle also secured reserve champion with the champion's dam, Ascot Vale Lydia Pride, a really good sow,

which has reared excellent litters. E. L. Melville and the Wide Bay Stud shared awards in the class for sows eleven months old and under seventeen months, in which Mr. Campbell's exhibit also was placed.

Plate 185.

Mr. P. V. Campbell's prize winning Tamworth Sow and Litter. The sow, "Wattledale Lydia Pride," was giving her litter liberal supplies of milk, and is herself a really good mother.

The first prize sow in the under five months old class, shown by Mr. Barkle, also has since been sent to Western Australia. Mr. Campbell won in the boar and progeny class, and Mr. Barkle secured the breeders' group award.

WESSEX SADDLEBACKS.

The Wessex Saddleback breed is making steady progress, and this year's exhibits were the best that have been seen at any Australian show so far. The championship was won in the male classes by Pensilva Monarch 2nd, shown by Bruce P. Stephens, of the Richmond River, New South Wales. E. B. Ruthenberg's exhibit also was a winner in the aged boar class. The reserve champion boar was R. Turpin's Pensilva Jumbo 3rd.

The sows and litters were good, the awards being gained by R. Turpin, the original importer of this type, whose entries, with those of Messrs. Stephens, Ruthenberg, and Sellars, also were awarded prizes.

YIELD OF CARCASE IN PORK AND BACON PIGS.

The loss of weight in transit of a pig from farm to factory, and then during dressing, varies very much, and it is not possible to say exactly what weight a pig will lose.

Factors which affect the amount of loss are:—The size of the pig—the larger pig will lose a lower percentage—the manner in which the pig had been fed; the length of the journey from farm to factory; the conformation and condition of the pig and the amount of food contained in its alimentary tract when it is weighed alive.

In tests it has been shown that under conditions similar to those ordinarily ruling in Queensland, pigs weighing 150 lb. to 200 lb. alive on the farm lose about 10 per cent. of this weight in transit to the factory, and then another 20 per cent. in dressing. Lighter pigs, weighing 100 lb. to 140 lb. alive, usually lose approximately 33 per cent. by the time they are dressed. Whilst these figures possibly are a fair average, individual pigs vary considerably according to the factors already mentioned.

As a rough guide in estimating dressed weight from live weight, farmers usually take seven-tenths of the live weight for baconers and two-thirds of the live weight for porkers.

—*L. A. Downey.*

A Substitute for Milk in Pig-feeding.

L. A. DOWNEY, Instructor in Pig Raising.

ONCE again at this time of the year most pig raisers are faced with the problem of feeding pigs with little or no milk. It is known generally that meatmeal is a good substitute for separated milk in the pig's diet, but unless it is used carefully, meatmeal may prove an expensive food.

Meatmeal, which is a by-product of abattoirs and meatworks, is sold under several trade names and some varieties contain a small percentage of bonemeal. It is a wholesome food, convenient to use, and costs from 9s. to 10s. 6d. per 100-lb. bag, Brisbane, the higher-priced brands containing a higher percentage of protein.

As meatmeal is so expensive in comparison with pig foods grown on the farm, it should not be used more freely than is necessary.

Separated milk, which meatmeal replaces, is used according to its availability, pigs sometimes receiving milk as their sole diet, but actually pigs will thrive on very small quantities of milk used in combination with grain and other foods such as pumpkins and sweet potatoes; the milk supplies a large part of the protein necessary to balance the ration. Each pig from the time of its weaning until the baconer stage and each dry sow should receive a minimum of three-quarters of a gallon of separated milk daily, and each sow with a litter double that quantity.

When these minimum quantities of separated milk are not available, meatmeal may be substituted, using $\frac{1}{2}$ lb. of meatmeal to replace each three-quarters of a gallon of separated milk.

Pigs thrive on a mixture of milk and meatmeal, or meatmeal alone as the protein-rich portion of the diet. The quantities used should not exceed from $\frac{1}{4}$ to $\frac{1}{2}$ lb. daily per pig from weaning to baconer stage, according as to whether good lucerne is available or not; and $\frac{1}{2}$ lb. for each dry sow and 1 lb. daily for each sow with litter.

By feeding a constant quantity of separated milk or meatmeal, and increasing the grain and other foods according to the pig's appetite, the nutritive ratio is widened automatically as the pig grows and satisfies its requirements.

In cases where pigs have access to good young pasture or green crops, the minimum quantity of separated milk or meatmeal stated above may be reduced by up to 50 per cent., depending on the quality of the green foods.

Meatmeal may be fed dry or mixed with milk or water.

"A PIG PRODUCER'S PARADISE."

"Climatic advantages which enabled the growing of abundant and cheap food all the year round and the keeping of pigs in the open with a minimum of expense makes Queensland what would be regarded by many less favourably situated countries as a pig producer's paradise." That was what a Southern pig farmer said to his neighbours when he got back home from a Queensland tour which included the Darling Downs, Gympie, and Mary River districts, where the conditions are, to his mind, the very best for large-scale pig raising. Of the pigs slaughtered for export last year, more than half were contributed by Queensland.

Export Bacon Pigs at the Brisbane Show.

TO encourage the production for export of the most desirable class of pig meat the Royal National Association provides attractive classes in its schedule each year. This year the class for export baconers suitable for the English trade provided for the judging of the pigs alive and as carcases.

The prize money for the class amounted to £40, of which £25 was provided by the Department of Agriculture and Stock, by direction of the Honourable the Minister, Mr. F. W. Bulcock.

The results of the competitions are so interesting and instructive to pig raisers that they are presented here, together with the comments of the judges, Messrs. E. J. Shelton, Senior Instructor in Pig Raising, and L. A. Downey, Instructor in Pig Raising. Mr. Downey judged the live pigs, and Mr. Shelton and Mr. Downey judged the carcases.

The schedule required entries of three baconer pigs, either pure-bred or sired by a pure-bred boar, each 180 lb. to 220 lb. live weight, most suitable for the English market.

The pigs were judged, firstly, alive on the showground on the 16th August as a pen of pigs using a score card, which, it was expected, would give exhibitors a little indication of their value, in the opinion of the judge. Notes made by the judge at the time of judging the live pigs are shown on the award sheets. The pigs were kept at the showground during show week, and then transported to the Brisbane Abattoir, where they were slaughtered on the 25th August. During the time the pigs were held at the showgrounds and at the Brisbane Abattoir they were fed; but there is a possibility of some of them gaining weight and of others merely maintaining their weight, or even losing. Probably the thin pigs became thinner and the fat pigs became fatter during the period.

After the pigs were slaughtered and dressed, and the carcases chilled, they were judged on the system of measurements as provided by English authorities for use on Empire pigs being supplied to the United Kingdom. This system of valuation has been standardised, after several years of research work, by three eminent scientists and one of Smithfield's leading authorities in the pork trade; it is based on measurements and standards which leave practically nothing to the individual opinion of the judge.* The system of valuation is closely related to consumer requirements, and so it can be taken as the most exacting and reliable guide to carcase quality. The marking standard of this English system is severe; and so it is a good carcase which gains 50 per cent. or more of the maximum marks. Measurements are taken in millimetres rather than inches to avoid fractions; 25 millimetres equals 1 inch.

When it is possible to judge carcases, there is little, if anything, to be gained by judging the pigs alive, for in the live pig the judge must use his imagination to some extent, and in the class under review it must be considered somewhat fortuitous that the pens awarded first and second alive gained the same awards in the carcase competition.

There were nine entries in the competition, and full details of the awards to individual pigs and to each entry are given in the attached sheets.

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* For further information of this system of carcase judging, see the Pig Breeders' Annual, 1936-37, or the "Queensland Agricultural Journal," August, 1937.

The class as a whole appeared to be a fairly good lot, although there were a number of entries which were obviously too thick—that is, too fat and short in relation to their weight—and there was sufficient difference between the best and the worst to provide a good object lesson to interested people.

Criticism during show week by breeders of pigs and others was interesting in that the bulk of opinion was that some individual pigs were much too thin. The carcases, however, revealed that most of the pigs were too fat rather than too thin, and the only pig which was too thin was actually only 3 millimetres below the ideal for backfat measurement and gained 17 marks from a maximum of 20, which was the fifth highest award for the whole twenty-seven pigs. This particular pig gained the highest score in the carcase judging, with 94 marks from a possible 115. This seems to indicate that general opinion favours a live pig which is actually too fat for the English trade, for which Australia is catering.

The carcase values of individual pigs may be seen from a study of the award sheets and the accompanying photographs, each telling a useful story.

Comments on the Individual Entries.

Entry No. 432, Large Whites, entered by Mr. S. S. Appleby, Maroon, were good baconers, one pig being noted as a little slack when judged alive. Actually this pig, although slightly thin, gained the greatest total when judged as a carcase. These pigs were good in most respects, their weakest feature being the eye of meat, which could have been thicker. This entry won both the live pig and carcase competitions.

Entry No. 433, Tamworth x Berkshire pigs, were entered by Mr. H. C. Badke, Beaudesert. They were noted alive as being too short and thick, and the carcases revealed this to be the case, as the three pigs gained only 30 per cent. for backfat thickness, and 11·6 for body length in proportion to weight, even though they were very lightweight carcases. This indicates that they were more of the porker type pigs than of the heavy baconer type.

Entry No. 434, Tamworth, entered by Mr. P. V. Campbell, Lamington, were considered to be too short and fat in the middle, and too long in the legs when judged alive. Their carcases lost points on the hams, and gained only 31·6 per cent. for backfat and 13·3 per cent. for body length, in proportion to weight. One of these pigs, weighing 161 lb., gained the lowest award for leg length, its leg measuring 612 millimetres.

Entry No. 435 were Mr. M. Gnech's Berkshire x Tamworth. They were noted as being too short and thick at the live judging. Their carcases scored well in many respects, but lost heavily in backfat and body length. These pigs probably would have made good heavy porkers, or light baconers, but were over-conditioned at heavy bacon weights.

Entry No. 436 were Large Whites, shown by Mr. J. A. Heading, Murgon. At the live judging they were noted as good but somewhat thick, and were placed sixth, being 5 points behind the third prize pen. Their carcases scored very well in most respects, gaining well in streak

and backfat, but receiving only 23 per cent. for body length. However, their consistency in all other points brought them up to third place in the carcase competition.

Entry No. 437, Mr. E. L. Melville's Tamworths, were noted as a good pen, but too leggy and somewhat slack underneath. Their carcases gained 92·8 per cent. for eye muscle, which is particularly good. However, two carcases in this entry failed badly in being too fat and too short. They also were too long in the leg.

Entry No. 438 were Mr. E. B. Ruthenberg's Wessex Saddlebacks. These pigs were noted as being a good pen with one pig somewhat slack underneath, and one being over-conditioned. The carcases scored fairly well in all points excepting backfat, where two of them lost heavily through being too fat, the other pig scoring 16 out of 20 marks on this feature. This entry gained third place in live judging; but through two of the carcases gaining only one point from a possible 20 for backfat, the entry went back to fifth place in the carcase judging.

It is interesting to note that the general opinion on this pen at the showground was that one of the pigs was unfinished. Its carcase, however, gained 80 points, as compared with 62½ and 59½ gained by the other two pigs which were too fat.

Entry No. 439 was a pen of Wessex, exhibited by Mr. R. Turpin, Lowood. This pen gained second prize alive and second prize as carcases. The noting on this pen, when judged alive, was that they were a good lot but somewhat leggy and slack underneath. The remark about their leg length was not borne out by the measurement on the carcases; but the slackness underneath, apparent in the live pigs, probably can be associated with the marks gained for the streaks, which were not all that could have been desired. These carcases were consistently good, and one of their best features was their good thickness of eye muscle. Each of these pigs showed "seedy cut" in the belly.

An interesting feature about one pig in this entry, whose carcase weight was 163 lb., was its good body length. It was the longest bodied pig in the competition, measuring 836 millimetres, and gaining 18 marks out of 20 for this feature. This pig had 15 pairs of ribs, more than any other pig in the competition, and it also had 16 well-placed teats. This might be taken as an indication that good body length is associated with a large number of well-spaced teats.

Entry No. 440 were Berkshire x Large Black, exhibited by Mr. J Vellacott, Boonah. These pigs were noted, when judged alive, as being too thick for their weight, and they were placed last in the live awards. Their carcases gained fair marks in most respects and 89·5 per cent. for hams; but, in two of the most important features—namely, backfat and body length—they lost heavily, being much too fat and too short in comparison to their weights. These pigs' carcases all had a dark pigmentation on the skin.

Whilst it would not be wise to draw inferences regarding the comparative merits of various breeds for heavy bacon from the few pigs included in this report, individual breeders will be able to arrive at their own conclusions regarding the trend of "type" within their breeds.

TABLE I.

——	Maximum Marks.	Catalogue No. 432. Tattoo W1. Weights on 25-8-37. 150	165	145	Total Per Cent. of Three Pigs.	Catalogue No. 433. Tattoo W3. Weights on 25-8-37. 131	132	140	Total Per Cent. of Three Pigs.	Catalogue No. 434. Tattoo W4. Weights on 25-8-37. 183	141	161	Total Per Cent. of Three Pigs.
Awards for Live Pigs.													
Condition	70		67		95·7		52		74·2		58		82·8
Uniformity and type	20		18		90·0		12		60·0		15		75·0
General appearance	10		9		90·0		5		50·0		6		60·0
Total	100		94		94·0 First		69		69·0 Seventh		79		79·0 Fourth
Judge's comments on live pigs	..	Good one pig a little slack underneath.				Too short and thick.				Somewhat short in middle and too fat; too long in legs.			
Awards for Carcases.													
A. By inspection—													
Skin—Smooth and fine	5	5	5	5	100·0	4	4	4	80·0	4½	4½	4½	90·0
Fat—Firm	10	10	8	10	93·3	9	9	8	86·6	9	9	9	90·0
Hams—Well-filled and fine-boned	8	4½	8	4½	70·8	5	6	5	66·6	4½	4½	4	54·1
Shoulders—Light	7	5½	5½	7	85·7	4½	4½	4	61·9	5½	7	6	88·1
Streak—Thick, full of lean meat	12	11	11	11	91·6	5	5	5	41·6	7	5	7	52·7
B. By measurement (in mms.)—													
Eye muscle of loin—Thick	28	[45] 19	[40] 13	[43] 17	58·3	[42] 17	[43] 18	[34] 3	45·2	[52] 24	[37] 9	[45] 18	60·7
Back-fat thickness—Correct proportion to weight	20	[18] 17	[28] 12	[24] 16	75·0	[29] 1	[23] 16	[38] 1	30·0	[33] 4	[31] 1	[27] 14	31·6
Body—Long, in proportion to weight	20	[811] 17	[807] 10	[800] 17	73·3	[695] 2	[705] 4	[712] 1	11·6	[786] 1	[733] 6	[742] 1	13·3
Leg length—Short, in proportion to weight ..	5	[546] 5	[556] 5	[570] 4	93·3	[544] 5	[514] 5	[528] 5	100·0	[574] 5	[583] 2	[612] 1	53·3
Total	115	94	77½	87½		52½	71½	36		64½	48	64½	
Total (three carcases)	345		259		75·07 First		160		46·37 Eighth		177		51·01 Seventh
Grand Totals (live pigs and carcases) ..	445		353		79·3 First		229		51·01 Eighth		256		57·5 Sixth

Note.—Measurements for eye muscle, back-fat thickness, body length, and leg length are in millimetres, indicated by the [black] figures.

TABLE II.

—	Maximum Marks.	Catalogue No. 435. Tattoo W5. Carcase Weights on 25-8-37. 155	149	152	Total Per Cent. of Three Pigs.	Catalogue No. 436. Tattoo W6. Carcase Weights on 25-8-37. 152	150	142	Total Per Cent. of Three Pigs.	Catalogue No. 437. Tattoo W7. Carcase Weights on 25-8-37. 150	161	151	Total Per Cent. of Three Pigs.
Awards for Live Pigs.													
Condition	70		50		71·4		55		78·5		57		81·4
Uniformity and type	20		12		60·0		14		70·0		14		70·0
General appearance	10		5		50·0		6		60·0		6		60·0
Total	100		67		67·0 Eighth		75		75·0 Sixth		77		77·0 Fifth
Judge's comments on live pigs		Too short and thick.				Good, somewhat thick.				Good; leggy, and a little slack underneath.			
Awards for Carcases.													
A. By Inspection—													
Skin—Smooth and fine	5	4	4	4	80·0	4½	4½	4½	90·0	3½	3½	3½	70·0
Fat—Firm	10	10	10	10	100·0	7	7	7	70·0	7	7½	7	71·7
Hams—Well-filled and fine-boned	8	8	7	7½	93·7	5½	5	5½	66·6	4	4	4	50·0
Shoulders—Light	7	3½	3	3	45·2	4½	4½	4½	64·3	6	6	6	85·7
Streak—Thick, full of lean meat	12	7	7	7	58·3	10	10	10	83·3	9	9	9	75·0
B. By Measurement (in mms.)—													
Eye muscle of loin—Thick	28	[48] 22	[44] 18	[45] 19	70·2	[49] 23	[45] 19	[47] 21	63·1	[51] 25	[52] 25	[54] 28	92·8
Back-fat thickness—Correct proportion to weight	20	[30] 4	[35] 1	[29] 7	20·0	[23] 18	[24] 18	[18] 18	90·0	[33] 1	[32] 1	[26] 14	26·6
Body—Long, in proportion to weight	20	[728] 1	[706] 1	[728] 1	5·0	[751] 5	[733] 2	[742] 7	23·3	[743] 4	[764] 4	[780] 11	31·6
Leg length—Short, in proportion to weight	5	[503] 5	[512] 5	[522] 5	100·0	[546] 5	[564] 5	[558] 5	100·0	[587] 3	[590] 3	[580] 3	60·0
Total	115	64½	56	63½		82½	75	82½		62½	63	85½	
Total (three carcases)	345		184		53·33 Sixth		240		69·56 Third		211		61·15 Fourth
Grand Total (live pigs and carcases)	445		251		56·4 Seventh		315		70·7 Third		288		64·7 Fourth

Note.—Measurements for eye muscle, back-fat thickness, body length, and leg length are in millimetres, indicated by the [black] figures.

TABLE III.

	Maximum Marks.	Catalogue No. 438. Tattoo W8. Carcase Weights on 25-8-37. 151	152	146	Total Per Cent. of Three Pigs.	Catalogue No. 439. Tattoo X7. Carcase Weights on 25-8-37. 157	170	163	Total Per Cent. of Three Pigs.	Catalogue No. 440. Tattoo X8. Carcase Weights on 25-8-37. 157	168	161	Total Per Cent. of Three Pigs.
AWARDS FOR LIVE PIGS.													
Condition	70		58		82·8		67		95·7		50		71·4
Uniformity and type	20		15		75·0		16		80·0		12		60·0
General appearance	10		7		70·0		8		80·0		5		50·0
Total	100		80		80·0 Third		91		91·0 Second		67		67·0 Eighth
Judge's comments on live pigs		Good; one a little slack underneath, and one over-conditioned. Bone coarse.				Good: somewhat leggy and slack underneath.				Too thick for their weights.			
AWARDS FOR CARCASES.													
A. By Inspection—													
Skin—Smooth and fine	5	3	3	3	60·0	3½	3½	3½	70·0	3½	3½	3½	70·0
Fat—Firm	10	9	9	9	90·0	7	7	7	70·0	7	5	6	60·0
Hams—Well-filled and fine-boned	8	3	4	4½	47·9	6	5½	6½	75·0	7½	7	7	89·5
Shoulders—Light	7	4½	4½	4½	64·3	5	4	6	71·4	3	3	3	42·8
Streak—Thick, full of lean meat	12	6	6	6	50·0	8	8	8	66·6	7	7	7	58·0
B. By Measurement (in mms.)—													
Eye muscle of loin—Thick	28	[43] 17	[42] 16	[45] 19	61·9	[53] 27	[50] 23	[46] 19	82·1	[42] 16	[42] 15	[47] 20	60·7
Back-fat thickness—Correct proportion to weight	20	[33] 1	[32] 1	[24] 16	30·0	[26] 14	[31] 7	[22] 20	68·3	[37] 1	[36] 1	[32] 1	5·0
Body—Long, in proportion to weight	20	[793] 14	[780] 11	[782] 13	63·3	[798] 13	[802] 7	[836] 18	63·3	[724] 1	[709] 1	[762] 1	8·3
Leg length—Short, in proportion to weight ..	5	[548] 5	[552] 5	[560] 5	100·0	[546] 5	[587] 5	[563] 5	100·0	[528] 5	[537] 5	[551] 5	100·0
Total	115	62½	59½	80		88½	70	93		51	47½	52½	
Total (three carcases)	345		202		58·55 Fifth		251½		72·89 Second		154		44·64 Ninth
Grand Total (live pigs and carcases) ..	445		282		63·3 Fifth		342½		76·9 Second		221		49·6 Ninth

NOTE.—Measurements for eye muscle, back-fat thickness, body length, and leg length are in millimetres, indicated by the [black] figures.

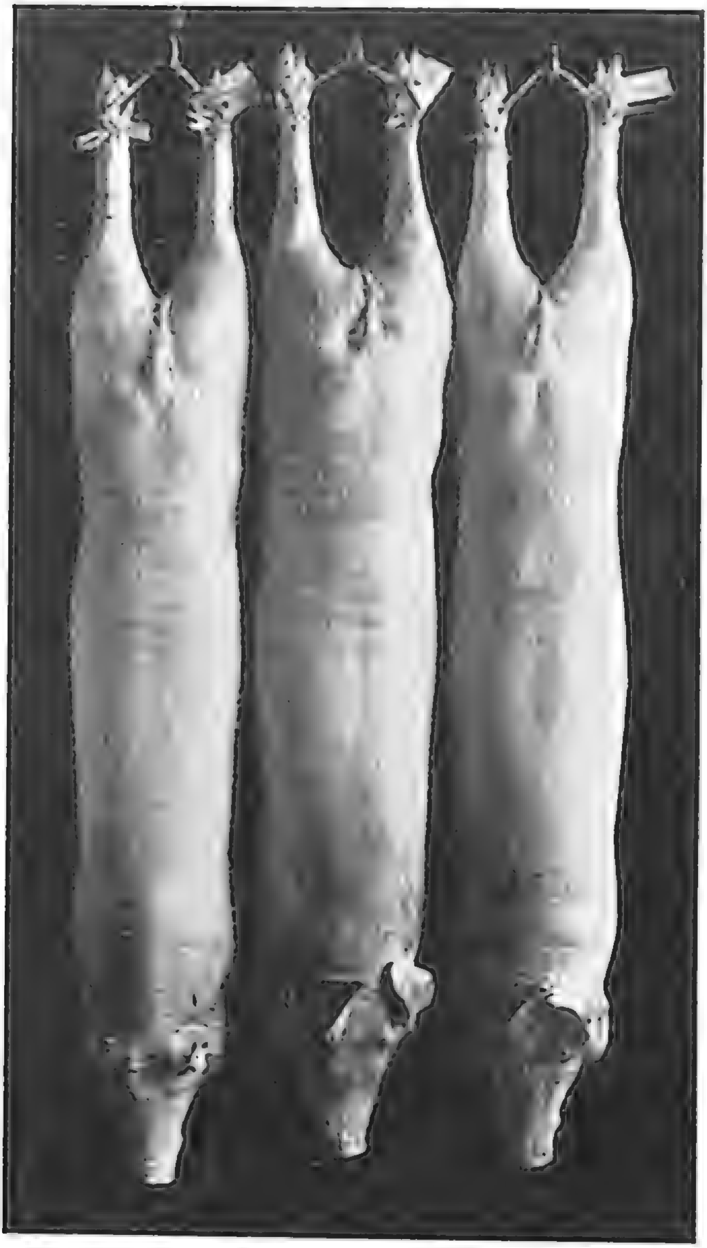


Plate 186.

Catalogue No. 432—Mr. S. S. Appleby's carcases of Large Whites, which gained first prize. Carcase weights, from left to right, 145, 165, 150 lb. Note the great length in proportion to weight, giving a long, narrow appearance. This entry gained the highest points for body length.

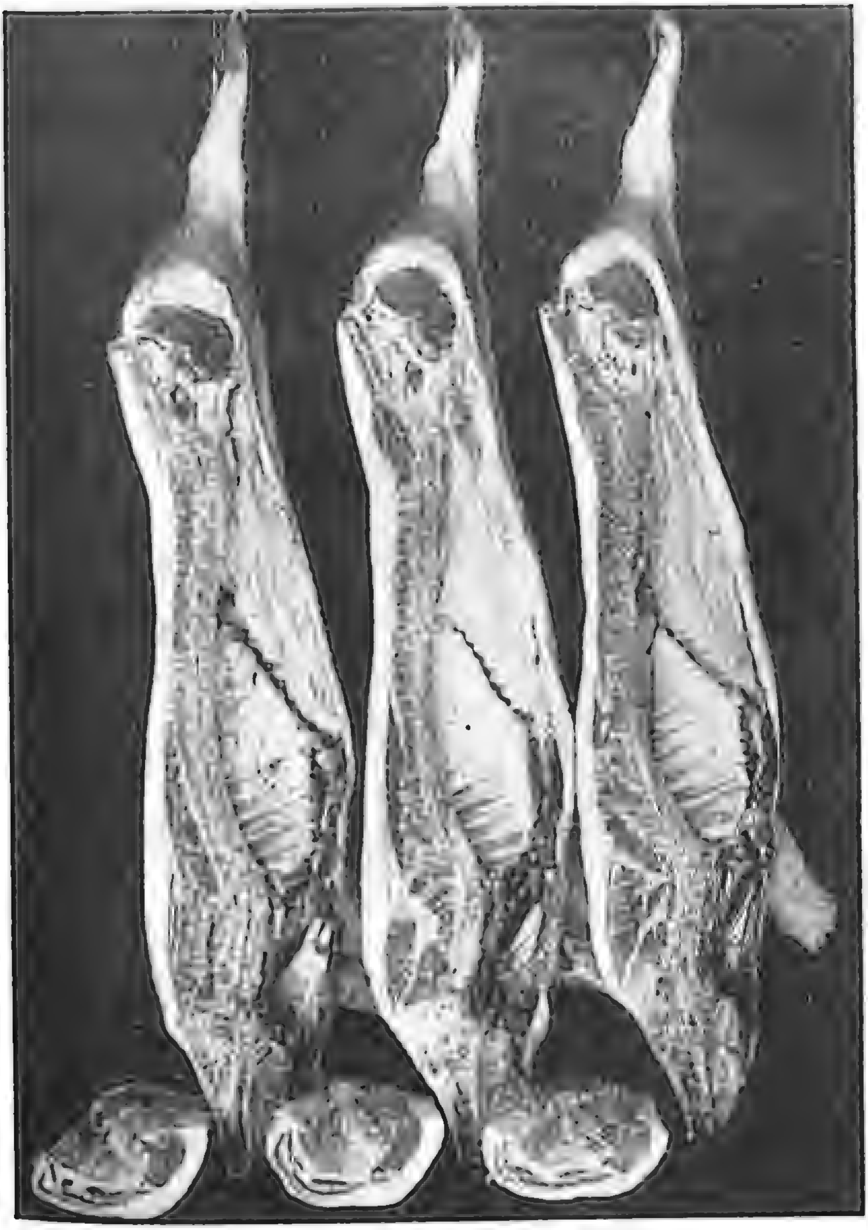


Plate 187.

The cut carcases of entry No. 432, as shown on the opposite page. Carcase weights, from left to right, 145, 165, 150 lb. Note the light covering of back fat and the thick, lean streak. This entry gained second highest award for back fat and the highest award for streak.

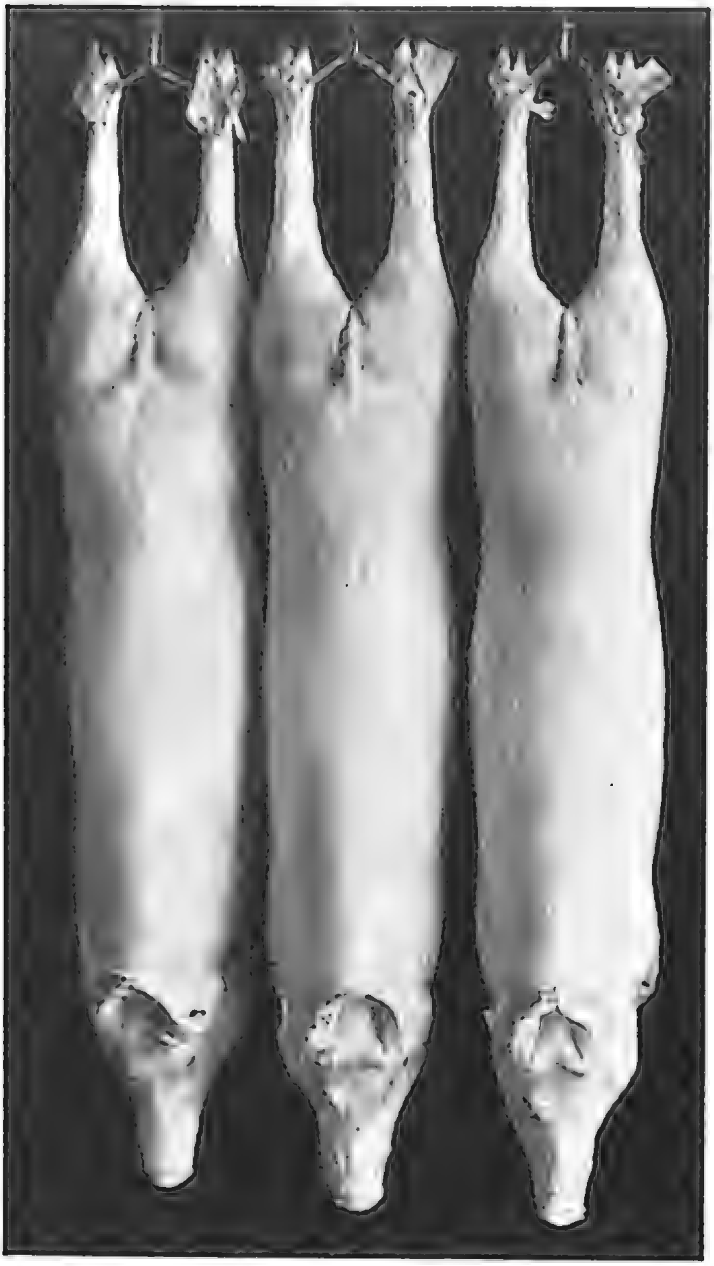


Plate 188.

Catalogue No. 433—Mr. H. E. Badke's Tamworth x Berkshire carcases, weighing, from left to right, 140, 132, 131 lb. These carcases were too short in relation to their weight. They were placed eighth in the carcase judging.

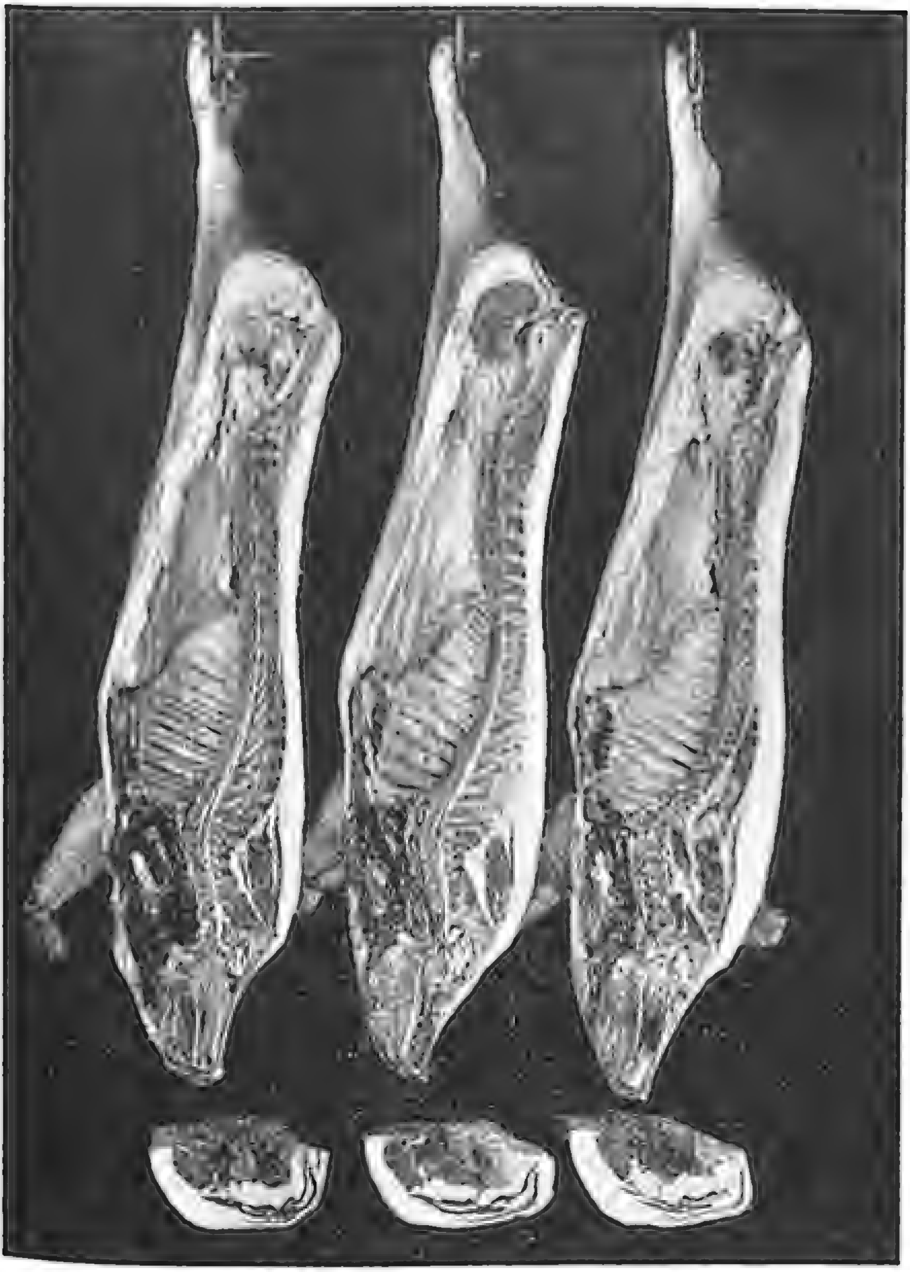


Plate 189.

The cut carcases of entry 433, shown on the opposite page; the weights, from left to right, are 131, 132, 140 lb. It will be noted that these carcases are comparatively fat.

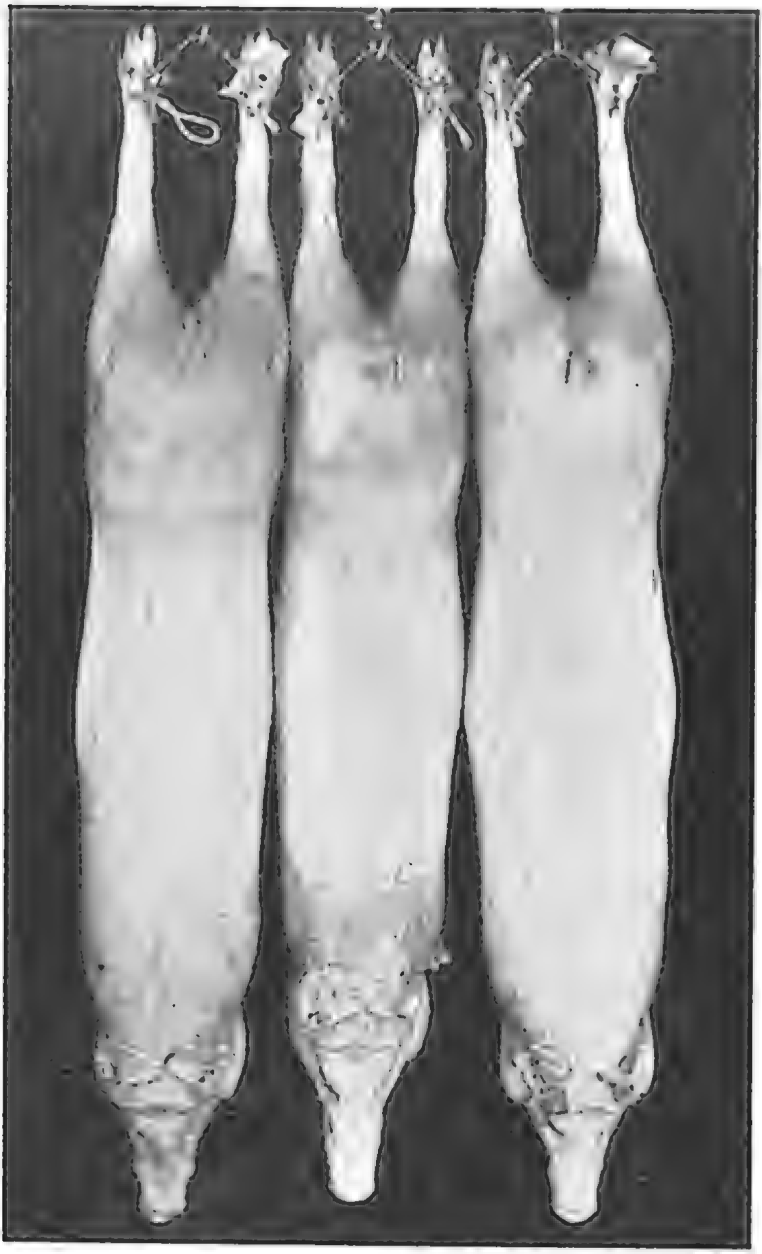


Plate 190.

Catalogue No. 434—Mr. P. V. Campbell's carcases of Tamworths, whose dressed weights are, from left to right, 161, 141, 183 lb. These carcases had particularly light shoulders, but were much too short in the body, and carried too much fat. They were placed seventh in the carcase awards.

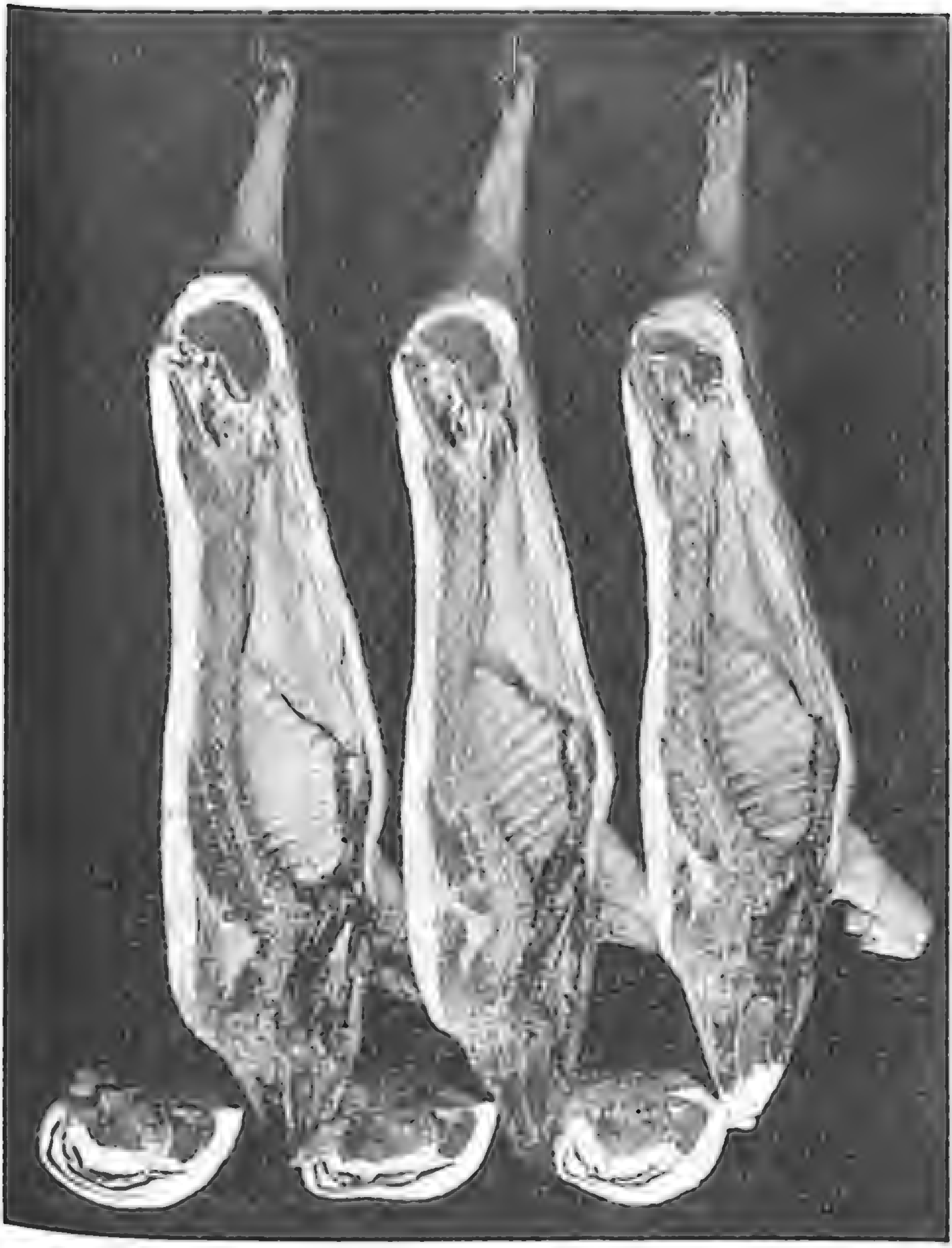


Plate 191.

The cut carcases of entry No. 434, shown on the opposite page; weights, from left to right, are 183, 161, 141 lb.

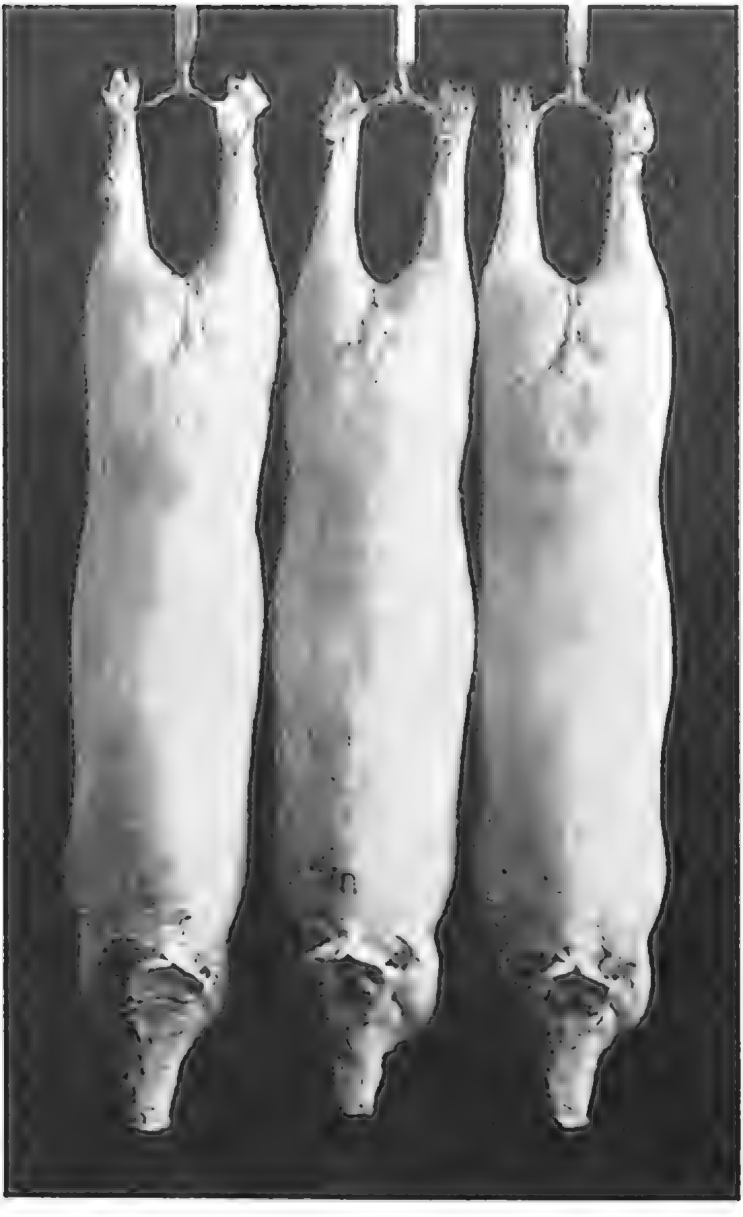


Plate 192.

Catalogue No. 435—Mr. M. Gnech's Berkshire x Tamworth carcases, weighing, from left to right, 155, 149, 152 lb. These carcases scored well for hams, but lost because the bodies were not long enough in proportion to their weights. They were placed sixth in the carcase competition.

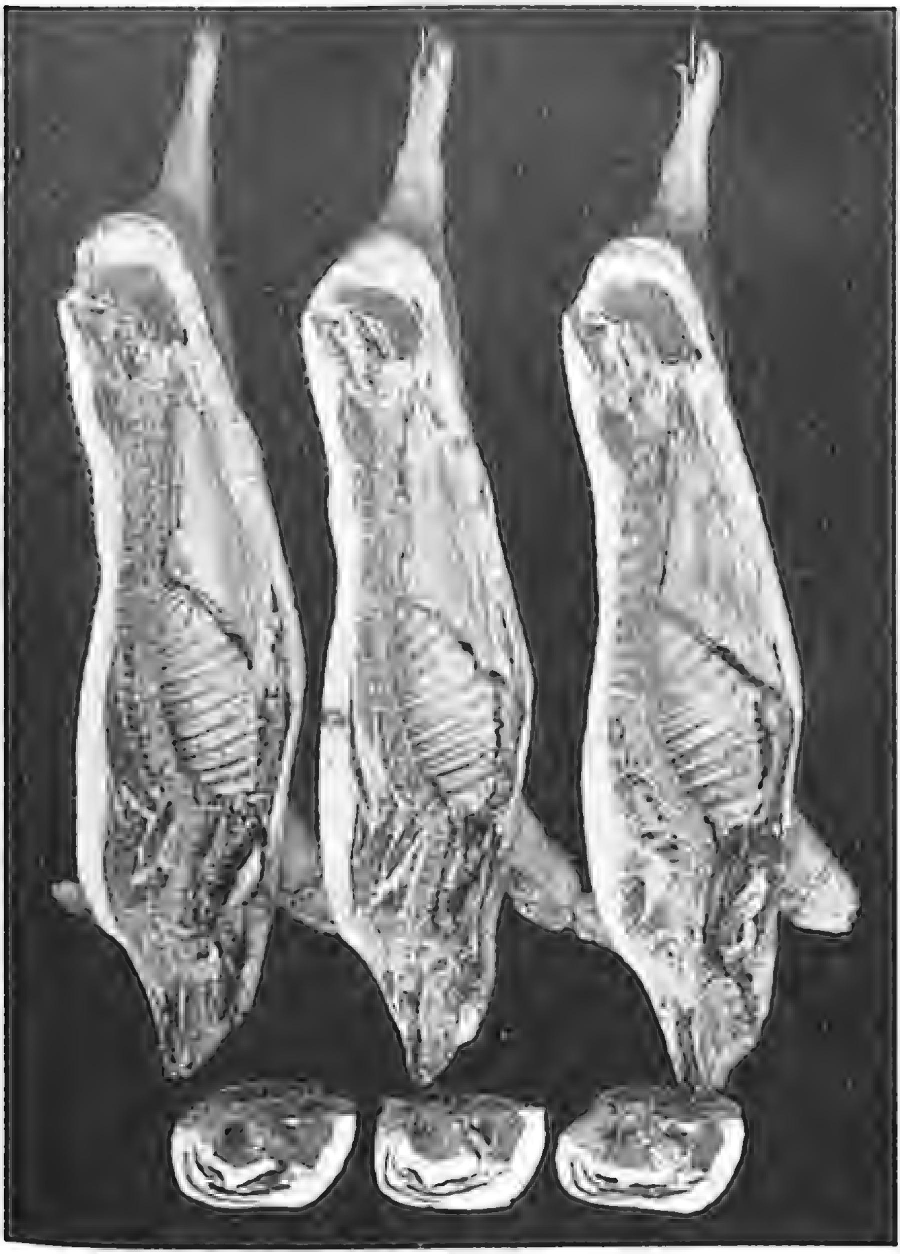


Plate 193.

Cut carcases of entry 455, shown on the opposite page. Carcase weights are, left to right, 155, 149, 152 lb. Note the excessive amount of fat, which was responsible for the weight being out of proportion to the body length.

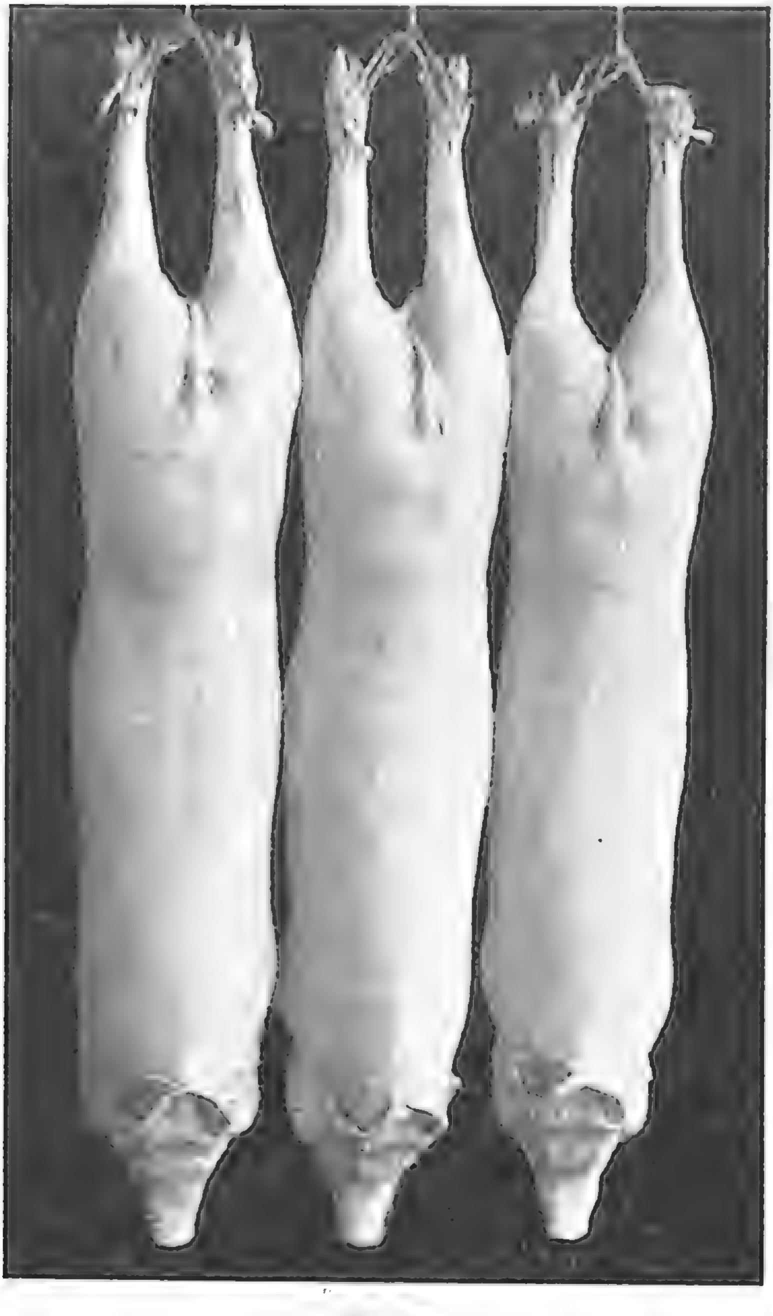


Plate 191.

Catalogue No. 436—Mr. J. A. Heading's carcases of Large Whites, which won third prize. Their weights are, left to right, 172, 150, 142 lb. These carcases scored fairly well throughout, gained the highest points for amount of back fat, but were too short for their weight.

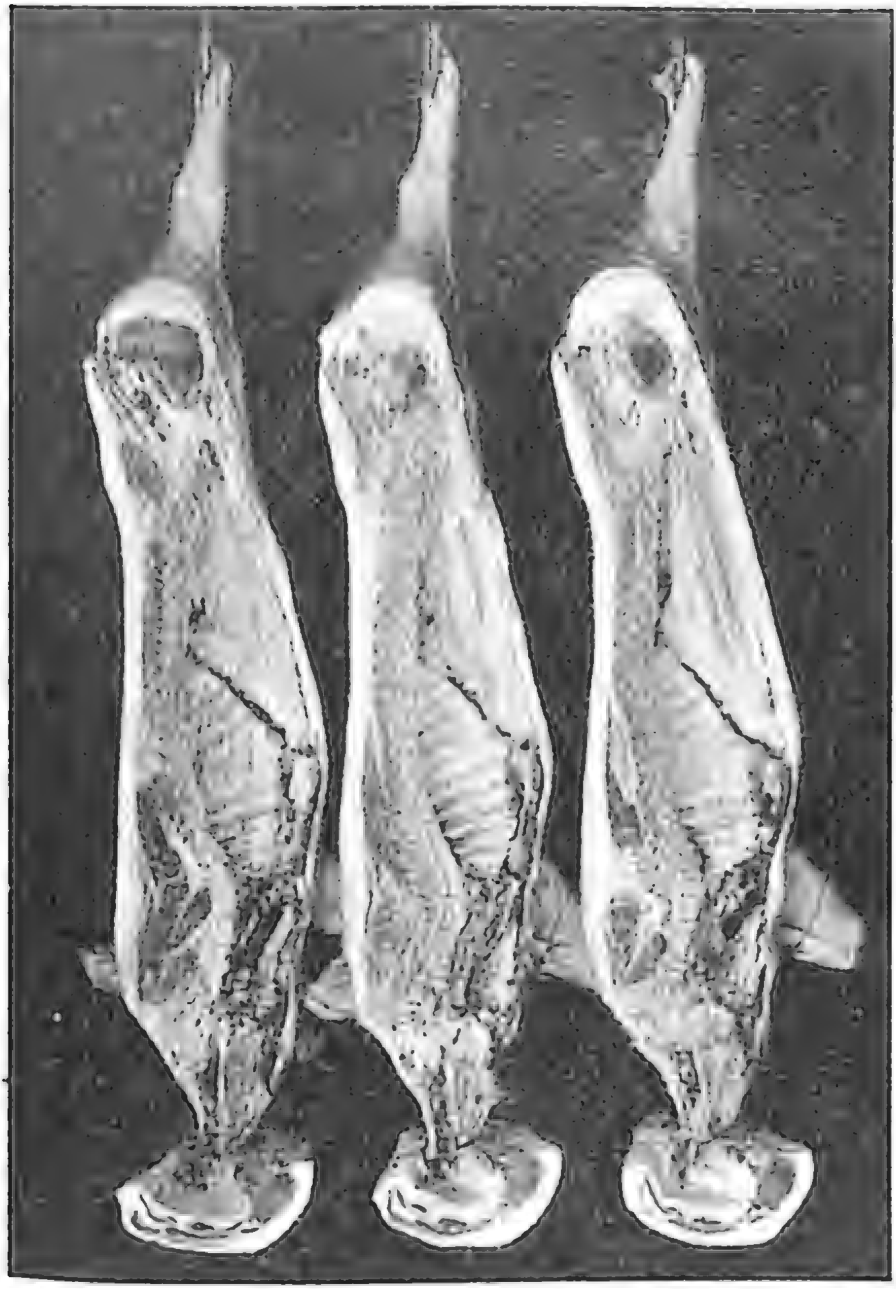


Plate 195.

The cut carcases of entry 436, shown on page 466, the weights being, from left to right, 142, 150, 152 lb. Notice the light covering of back fat and the good streaks.

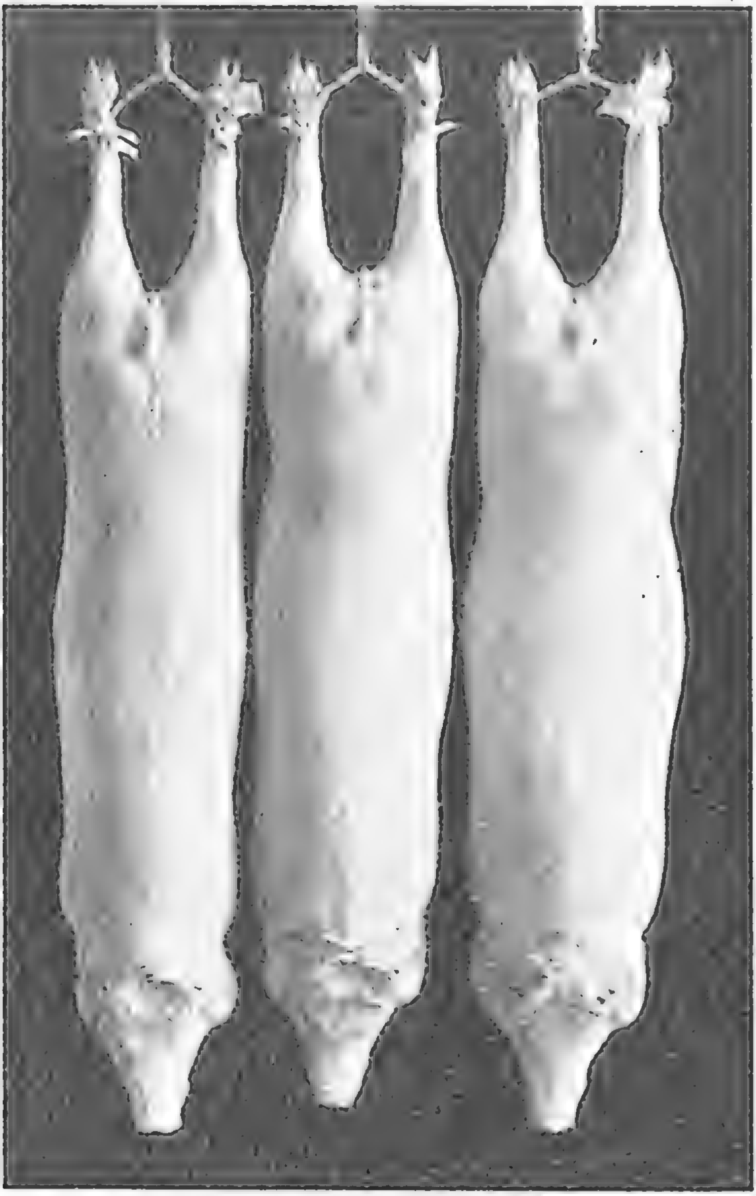


Plate 196.

Catalogue No. 437—Mr. E. L. Melville's Tamworth carcases, weighing, from left to right, 151, 161, 150 lb. These pigs scored fairly well in most features, but carried too much back fat. This entry gained fourth place in the carcase judging.

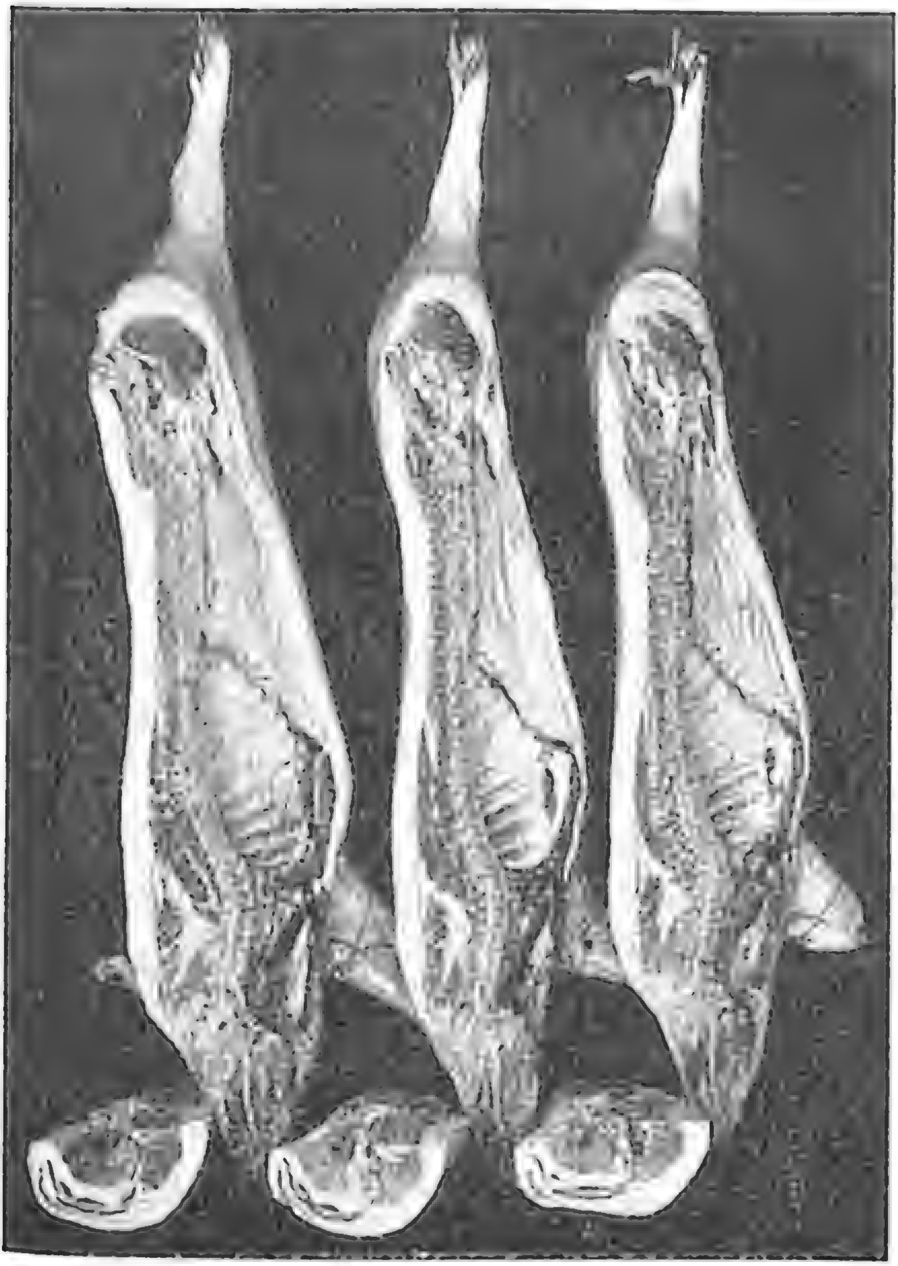


Plate 197.

The cut carcases of entry No. 437, shown on the opposite page. Weights are, from left to right, 161, 151, 150 lb. Note the thickness of the eye muscle. This entry scored 92.8 per cent., the highest award, for this particular feature, but lost points for carrying too much back fat.

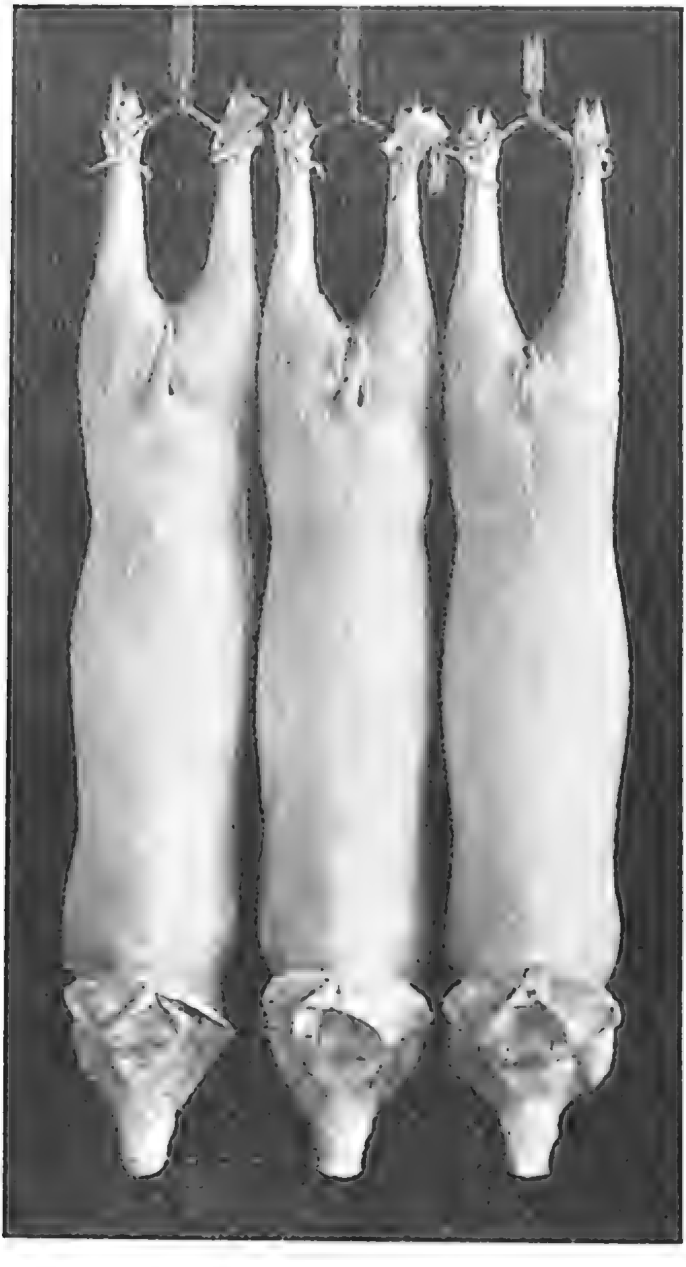


Plate 198.

Catalogue No. 438—E. B. Ruthenberg's Wessex carcases, weighing, from left to right, 146, 152, 151 lb. These were good carcases, but lost points through two of them being over-fat. This entry gained fifth place as carcases.

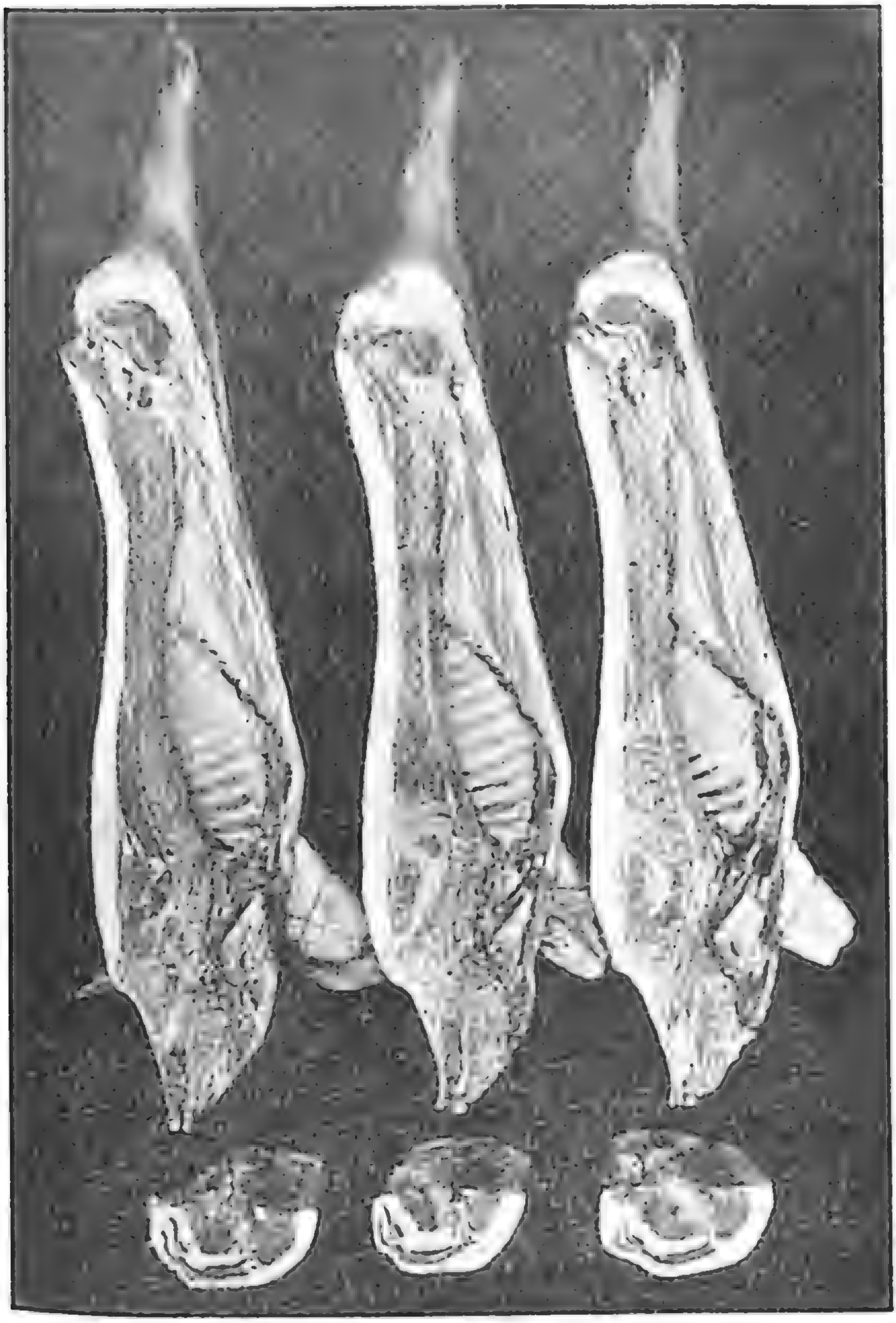


Plate 199.

The cut carcases of entry 438, shown on opposite page; the weights, from left to right, being 146, 151, 152 lb.

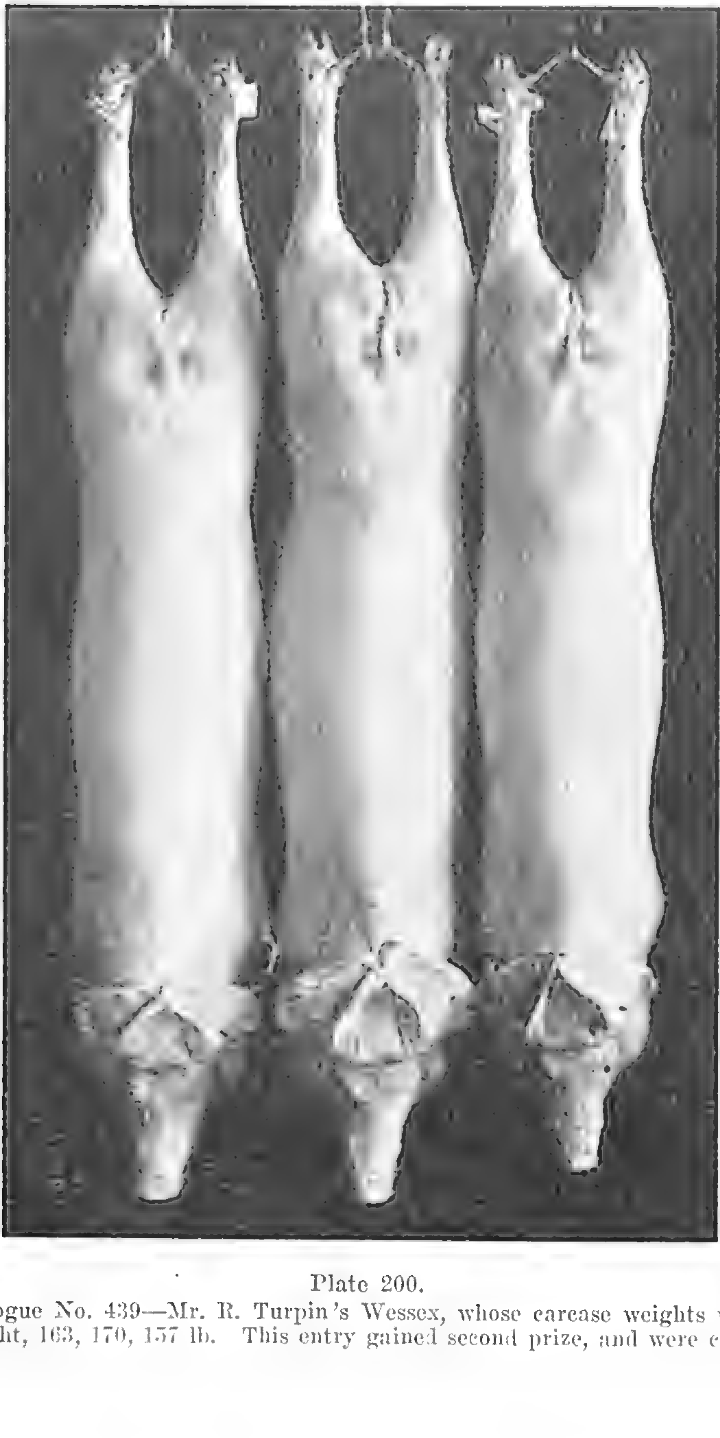


Plate 200.

Catalogue No. 439—Mr. R. Turpin's Wessex, whose carcase weights were, from left to right, 163, 170, 157 lb. This entry gained second prize, and were consistently good.

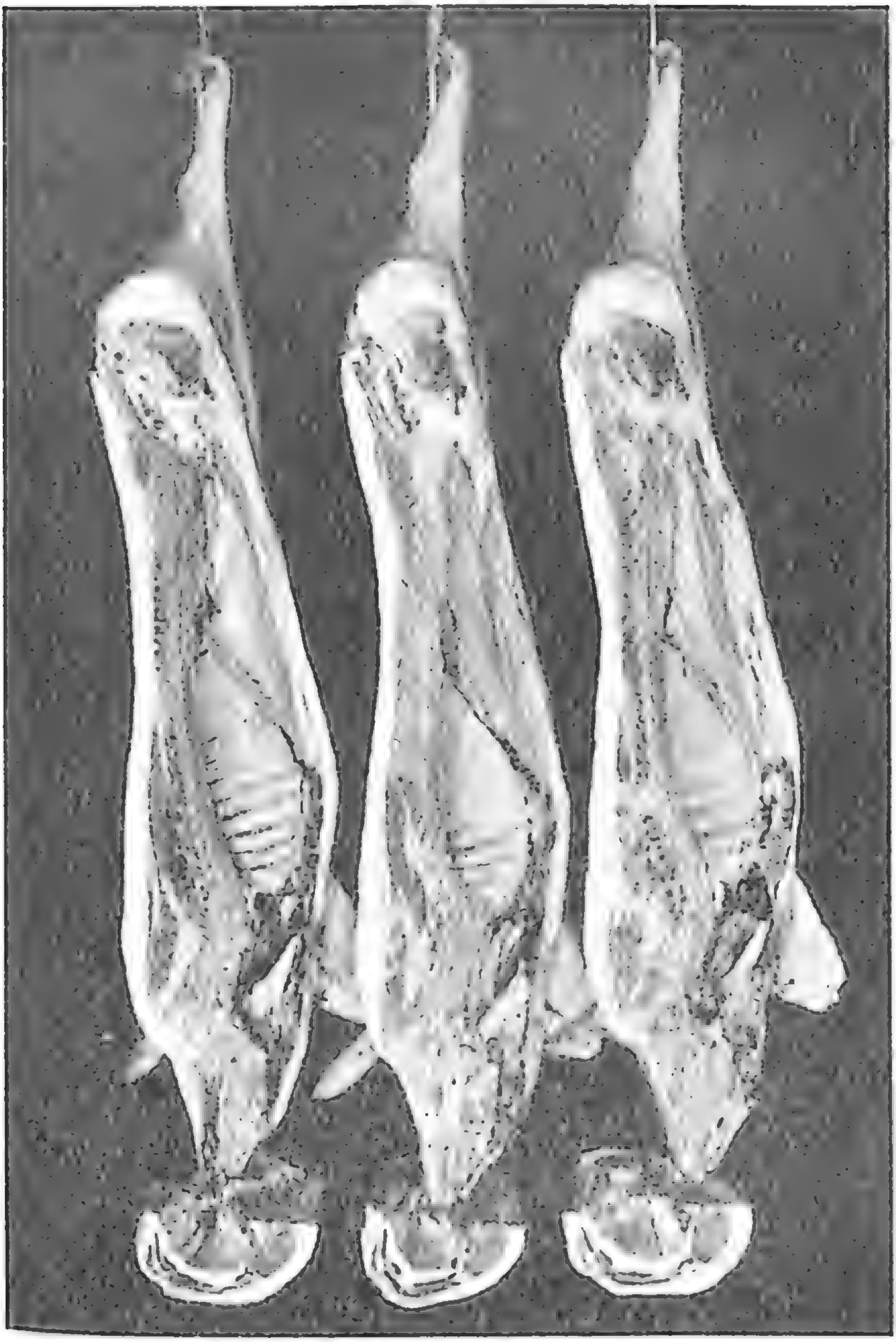


Plate 201.

The cut carcases of entry 439, shown on the opposite page, their weights, from left to right, being 157, 163, 170 lb. The carcase weighing 163 lb. scored the possible points for back-fat thickness, and 18 points out of 20 for body length.

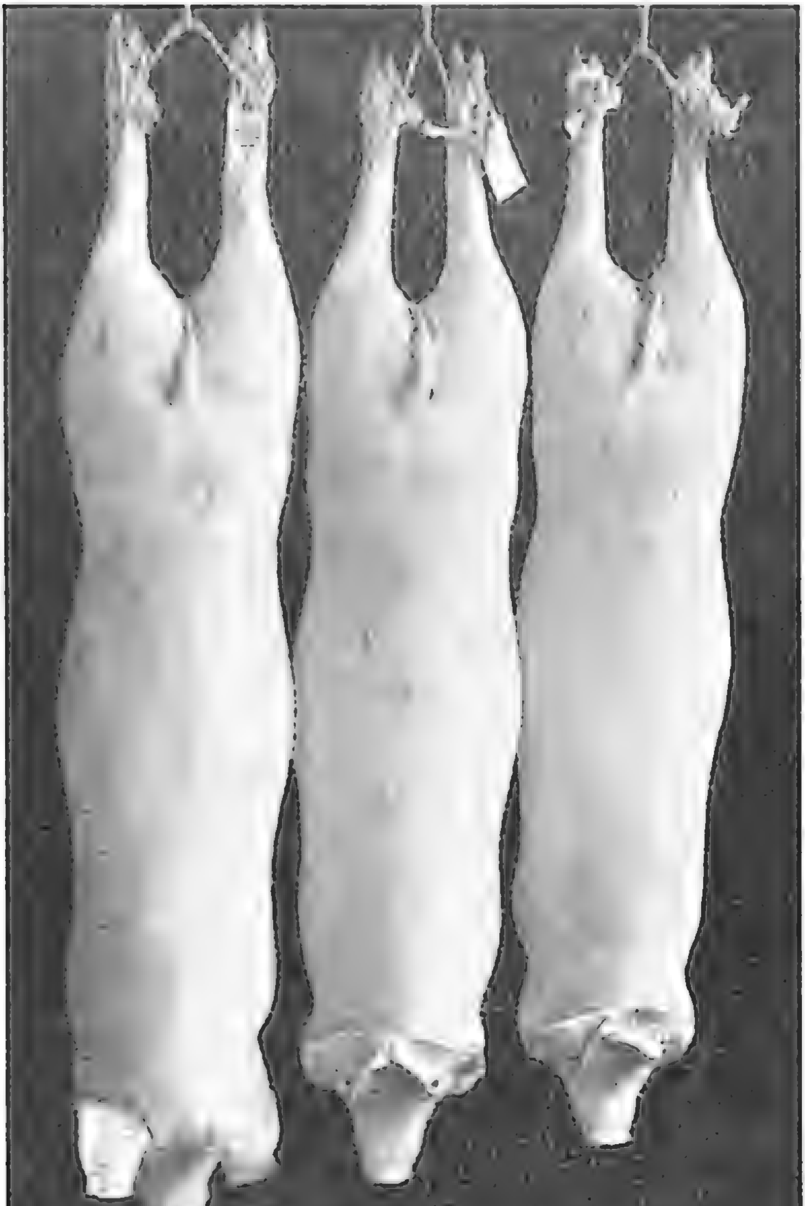


Plate 202.

Catalogue No. 440—Mr. J. Vellacott's Berkshire x Large Black carcases. Their weights were, from left to right, 161, 168, 157 lb. These carcases were good in the hams, but excessively heavy in the shoulders, and the bodies were much too short for their weights. They were placed last in the competition.

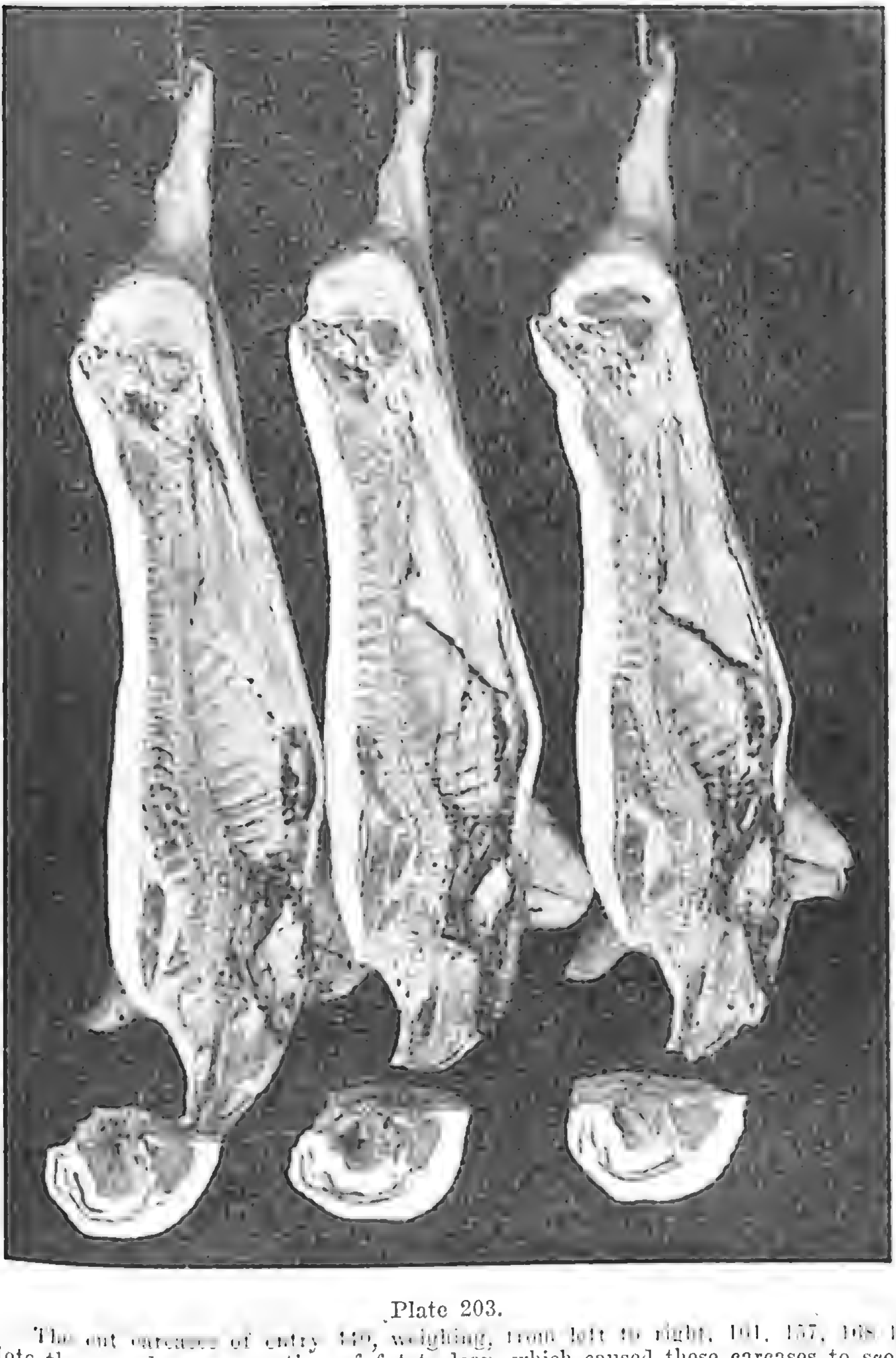


Plate 203.

The cut carcases of entry [illegible], weighing, from left to right, 161, 157, 168 lb. Note the very large proportion of fat to lean, which caused these carcases to score low points.

Housing Cockerels.

P. RUMBALL, Poultry Expert.

IN the rearing of any large number of cockerels, either for stud or table purposes, one of the outstanding problems is that of providing satisfactory housing. It happens frequently that cockerels are injured by fighting amongst themselves. Generally speaking, fighting is more prevalent among light breeds, such as white leghorns, than among Australorps and other heavy breeds.

The rearing of a large number of cockerels of a similar age could be arranged to great advantage by the provision of a special house. The type of house recommended is one in which the roof reaches approximately 2 feet from the ground. For efficiency, economy, and simplicity of construction, a building of the gable-end type should meet requirements. The size, naturally, will depend on the number of birds to be accommodated. A building 12 feet long by 8 feet wide will accommodate, as a maximum, 100 white leghorns or 80 Australorps. Approximately 1 square foot of floor space is allowed for each bird. Hens, however, should be provided with double that area under the same system, and the small space proposed for the cockerels is only practicable because of the fact that they will occupy the house only for a short period.

In the construction of such a building, the four corner posts may be 3 feet, and the two centre posts 7 feet high. By using 8 feet iron the roof will extend to within 2 feet of the ground. The gable-end should face to a point between north and east. This will permit of the front being left uncovered, while the rear or westerly end should be covered with iron to within 2 feet of the ground. Perches are the only fittings necessary. These should be all on the same level, and 3 feet above the floor. They should run lengthwise, and should be spaced 2 feet apart. Such spacing would obviate fighting on the perches.

It is essential for a building of this type to be erected in the centre of a large netted run, or at a distance from other buildings if the birds are to be reared on free range. In addition, it is advisable to erect a number of perches in different parts of the run. Such perches should be 3 feet high and situated away from boundary fences.

The advantages of this system of handling cockerels are that there are no corners or walls in the building, and on being chased the bird can escape easily by getting on a perch. An old cock bird placed in the pen, before the cockerels are three months of age, will assist materially in preventing the young birds from fighting.

JUNIOR FARMERS' CLUBS.

Farmers in the making—the members of School Project Clubs—have many practical results to show for their youthful enthusiasm. In another State recently a young member topped the lamb sales with his stock. Another established an Australian record with 183 bushels of maize per acre, and yet a third gained the potato yield record. The movement is of great importance to a primary producing country like Queensland, since on the industry and efficiency of the next generation of farmers will rest the future of our land industries. The boys—and girls, too—are taught to call science to their aid, and to take advantage of modern knowledge and methods. At the cattle judging competition at a recent show, a judge of long experience remarked:—"If at their age I had known as much as these boys do, I would have been numbered among the great breeders long ago."

Care of Growing Pullets.

J. J. McLACHLAN, Poultry Inspector.

PULLETS are the principal source of profit during the period from March to June. Laying pullets are very easily upset—in fact, any slight alteration in feeding or management will be likely to bring about a cessation of egg production. For that reason, any proposed alteration in feeding or management should be made before the birds commence to lay.

Pullets should be so fed that their growth is continuous. If dry mash is fed there must be ample feeding space—1 foot of feeding space for each ten birds is recommended. The hoppers should be constructed so that the feed does not jamb and leave the trough empty; hoppers wider at the bottom than the top achieve this objective. There must be ample mash always before the birds. Any shortage will retard growth, or, if they are laying, cause a cessation of production. Should the wet mash feeding system be adopted, it is most advisable to give one full meal of mash early in the morning, followed by a smaller meal at midday. These meals should be fed approximately at the same hour each day. In feeding adult birds, the general practice is to supply only the morning meal of mash; and, if it is desired to adopt this practice for the pullets when they are mature, it is essential that the mid-day meal of mash be discontinued before they commence laying. Chaffed green-feed or soaked lucerne chaff could be fed at midday to replace the meal of mash.

Growing mash should be fed until the pullets are about four months old, and then a change made to laying mash. Making a change at this age has the advantage of not affecting the birds. Should the change be left until the pullets have commenced laying, it is essential that the process be gradual, and at least one week taken to complete the change.

As a general rule the evening meal consists of grain—wheat or maize, or a mixture of these cereals. If it is desired to make a change in the grain ration this should be done prior to the start of production; or, if later, the change should be a gradual process.

Irregular supplies of water will retard growth or affect production to a greater degree than any other factor. Therefore, a strict watch should be kept to see that the pullets have a constant supply of clean, fresh water, and that it is situated in a cool, shaded place.

Pullets that are being reared in colony houses or temporary quarters must be moved to the permanent houses before they commence laying. Should this work be delayed until after they have commenced laying, there would be a general cessation of production. The number in each unit is an important factor. Pullets will make more uniform growth and production will be highest when kept in relatively small groups. Groups above 100 are undesirable.

Under no circumstances should pullets be overcrowded. One of the most common faults in poultry management is that a large number of pullets are reared without making the necessary provision for their accommodation.

THE CHICKEN SEASON.

A large proportion of the chickens that will be hatched during the coming few months will be culled during the various stages of growth, as being unsuitable for production in the future. Some of the culling may be necessary on account of the parentage of the individual, but by far the greater number of culls will be due to the lack of care, attention, and feeding.

Owing to the high cost of poultry food, the improper feeding of the chickens, particularly during the early days of life, is likely to be responsible for a greater percentage of culls than any other cause. Foods that are most suitable for chickens during this period are relatively costly, and efforts may be made by many to economise by substituting foods which, while they might prove satisfactory for older stock, are not entirely suited for the growth of young chickens.

Economic production is only possible from the well-grown, well-fed and well-bred birds; consequently, it is essential to give the layer of the future a good start in life. When it is considered that growing chickens, during the first six or eight weeks, do not consume very large quantities of food, the saving that may be made by the cheapening of the ration does not reduce the first costs to any material extent.

The following table indicate the reasonable weekly food consumption for chickens of two of the most popular breeds, and the average weight that chickens might be expected to be at these periods:—

TABLE SHOWING WEEKLY FOOD CONSUMPTION AND WEIGHT OF CHICKENS.

Week.	Leghorns.		Australorps.	
	Food Consumed, in oz.	Weight of Chick.	Food Consumed, in oz.	Weight of Chick.
First	1·64	1·97	1·53	2·14
Second	3·36	3·31	3·32	3·61
Third	4·80	5.31	5·05	5·84
Fourth	6·46	7·61	7·20	8·68
Fifth	7·58	9·94	6·89	12·08
Sixth	8·96	12·92	10·62	15·86
Seventh	8·65	16·65	13·95	20·17
Eighth	13·29	20·41	15·05	25·31
Total	54·74	..	63·61	..

Pounds food consumed per 100 chicks in eight weeks—Leghorns, 342; Australorps, 398.

The above table indicates that it takes about 350 lb. of food per 100 to rear White Leghorn chicks to the age of eight weeks and approximately 400 lb. of food to rear Australorps to the same age. The saving of 2s. or 3s. per 100 lb. consequently makes very little difference to the cost, but it may materially and adversely affect the growth that is desired. In nutritional experiments that have been conducted at the Animal Health Station, the following rations have given most satisfactory results:—

Ration.	1-8 Weeks.	8 Weeks to Maturity.
	lb.	lb.
Maize Meal	40	60
Bran	20	13½
Pollard	20	13½
Meat and Bone Meal	7½	5
Dried Buttermilk	10½	3½
Salt	1	1
Cod Liver Oil	1	1
Lucerne Meal	..	2½
Crude Protein Content..	17·15%	14·40%

To those who mix their own rations, a mash containing the abovementioned ingredients is recommended. Those who prefer to buy a prepared mash should purchase none but mashes which have been made expressly for the purpose of feeding chickens and growing stock.

—*P. Rumball.*

THE TROPICAL FOWL MITE.

Most poultry farmers are familiar with red mite. Not many, however, are aware that there are two kinds of red mite, namely, the tropical fowl mite and the true red mite.

The tropical fowl mite is the more common of the two species. It usually lives and breeds upon the birds, though when very numerous the nest boxes and perches may also harbour them. The species is most frequent below the vent, on the tail, and sometimes on the neck. The female mite lays its eggs among the feathers. Here the young mites hatch, and may grow to maturity without leaving the bird.

The true red mite is slightly larger than the tropical fowl mite. Like the poultry tick, it is usually found on the birds only at night, hiding in the cracks and crevices in the perches, among litter, and in other sheltered places by day. In those places the female mite lays its eggs, the young mites visiting the birds only in order to feed.

Both the tropical fowl mite and the true red mite are blood suckers. When numerous they cause distinct injury, especially to young birds. Sitting hens may be so irritated as to leave the nest. In birds which are subjected to continuous attack, the feathers become dirty and bedraggled, and the skin takes on a scabby appearance. The true red mite is also a vector or carrier of the organism of fowl tick fever, a serious and frequently fatal disease.

These mites may be controlled easily if the following recommendations are carried out:—

(1) Remove and burn all litter, nesting straw, and similar material. See that the fowl-house is thoroughly clean.

(2) Spray the whole premises with crude oil or kerosene, forcing the spray well into all cracks and crevices.

(3) Paint the perches with nicotine sulphate half an hour before the birds go to roost. Repeat for two or three nights. This treatment is excellent, also, against lice.

(4) Watch carefully for any mites which have survived, and, if necessary, repeat the spraying with crude oil or kerosene and the painting of the perches with nicotine sulphate.

—*Dr. F. H. S. Roberts.*

FEEDING OF GROWING CHICKENS.

After chickens are eight weeks old, it is still possible to use the all-mash system, but the crude protein content should be reduced to approximately 15 per cent. The easiest way to do this is by lowering the quantity of protein meal and dried buttermilk. From that stage onwards, some more fibrous material may be included in the ration with advantage and possibly lucerne meal would be the most convenient and desirable form for this to take.

A ration which has been found satisfactory in the all-mash method of feeding growing stock consists of 60 per cent. of maize meal, 13½ per cent. each of bran and pollard, 5 per cent. of meat meal, 3½ per cent. of buttermilk powder, 1 per cent. of salt, and 1 per cent. of cod liver oil, and 2½ per cent. of lucerne meal. The approximate protein content of that ration is 15 per cent.

If it were desired to feed grain in conjunction with that mash on the basis of two-thirds mash and one-third grain, and maize was available for the purpose, it would have to be remembered that maize had a protein content of roughly 10 per cent., and that the ration therefore would contain less than the 15 per cent. of protein required. It, therefore, would be necessary to increase the protein-rich foods by adding either meat and bone meal, or dried buttermilk, and to reduce the maize meal used in the mash. If, on the other hand, there was plenty of skim milk available, the chickens could be given that to drink, and they would obtain from it sufficient protein for their requirements under those conditions. While it is possible for a fairly definite rule to be laid down as to the protein requirements of the chickens, some latitude in respect of the kinds of food used is allowable. Full information on this important subject is obtainable from the Department of Agriculture and Stock, Brisbane.

The Papaw.

H. BARNES, Director of Fruit Culture.

PART I.

THE native home of the papaw is recorded as being tropical America, although the actual part to which it is indigenous is not known definitely. The plant is easily propagated from seed, and this fact has aided its rapid dissemination throughout the tropical and, to some extent, subtropical, countries of the world. There appears to be no record of how and when it was introduced into Queensland, but it is now grown in all our coastal districts in frost-free situations. It probably is one of the most susceptible of tropical plants to frost injury, and should be planted always above this level.

THE PLANT, ITS HABIT, AND ITS FRUIT.

The papaw is a giant herbaceous plant rather than a tree, attaining a height of 12 to 20 feet. According to its natural habit it develops only one stem, with no lateral branches, and surmounted by a tuft of large palmate leaves borne on the end of long petioles. Its likeness to the palm has been remarked upon frequently. The height of the fruit from the ground, after the plant has made about three years' growth, results often in the fruit being bruised and damaged when it is being picked. This difficulty can be overcome largely by pinching out the terminal growth of the young plant when it is 2 to 3 feet high. This will cause the single stem to divide into several secondary stems, all of which will bear fruit, and which naturally will not grow to such a height as it would if the plant were allowed to grow with a single stem.

Normally, the plant is of diœcious habit with staminate and pistillate (male and female) flowers produced on different plants. The flowers are produced in the uppermost axils of the leaves, and in the case of the male tree the flowers are white and are borne on the end of long pendant

racemes 2 to 3 feet in length (Plate 205). These flowers sometimes are of a hermaphrodite nature, and it is on this account that they are followed at times by small elongated fruit of no value. The flowers of the female tree are more yellow in colour, are larger, of a bell shape, and are subsessile (Plates 206 and 207).

As a general rule the first crop is borne twelve to eighteen months from planting, depending largely upon the time of planting and weather conditions (Plate 208).

Plate 204.

A papaw plantation at Sunnybank, near Brisbane (the property of Mr. W. Parker).

The fruit of the papaw varies in shape according to the variety from spherical to cylindrical, and when mature is of a bright yellow colour. The flavour varies somewhat in different varieties, and is influenced also by the conditions under which it is produced. Generally, however, it may be described as sweet, though at times insipid, and to some demands an acquired taste. Often it can be made more palatable by the addition of sugar, lemon, or orange juice, or wine. The fruit makes a splendid ingredient in the preparation of fruit salads, and is made also into excellent sauces, jams, chutneys, &c., whilst when green, after being allowed to soak to remove the milky juice and then boiled, it is quite equal to vegetable marrow. Many claims are made for the wonderful medicinal qualities of the papaw. It is credited with possessing remarkable digestion promoting properties, as also are the seeds, which resemble watercress in flavour. An active principle known as Papain, which greatly resembles Pepsin in its digestive action, and is sometimes used as a substitute for the latter, is present in the milky sap of the fruit and in all parts of the plant.

VARIETIES.

In recent years much attention has been directed to the evolution of perfect bisexual or hermaphrodite types in an endeavour to dispense with the necessity for male trees in an orchard for the purposes of cross

pollination. The late Director of Fruit Culture (Mr. G. Williams) stated in an article in the "Queensland Agricultural Journal" for December, 1931, that two bisexual varieties, the New Guinea or "Long Tom" and the Cowleyii or "New Era" introduced into the North some years ago were worthy of mention, but that the typical features by cross-fertilization had been almost eliminated. The truth that is contained in this statement is evident from a study of the fruit arriving at the markets from different districts. Modifications of these two original varieties are the most largely grown in Queensland at the present time, though the Cowleyii probably takes preference over the New Guinea type. A roundish fruit rather than a long cylindrical type is preferable for the fresh fruit market.

Plate 205.
Male papaw plant in flower at Brookfield, near Brisbane.

PLANTING.

It is wise for intending planters to select their own seed from large, well-formed fruit which have been allowed thoroughly to mature on the tree. The seed should be well washed in fresh water and then dried in the shade. Early spring is a good time for sowing the seed, though some growers sow early in the new year with very good results. The use

of specially prepared seed-beds subjected to partial shade is the recommended practice. If the beds are kept well watered the young plants will appear in a short time, and when about 8 to 12 inches high may be transplanted to their permanent positions. When planting out, the foliage, except the young undeveloped crowns, should be removed to reduce evaporation from the plants. Here a note of caution may be sounded. If at any time during the life of the papaw plant it is necessary to remove foliage, only the leaf blade should be cut away, allowing

Plate 206.

Female papaw in flower and fruit (note flowers above the young fruit) in a plantation at Brookfield.

the petiole or leaf stalk to remain on the stem. If the petiole is removed whilst green an entrance to the stem of the plant is allowed for various rot-producing fungi, whereas if it is left on the plant the latter has a

chance to protect itself by the deposition of a layer of corky bark at the junction of the petiole and stem, and no open wound is left through which disease can gain an entrance.

Plate 207.
Female Flowers and Fruit of Papaw.

Where young plants are grown under shade, this should be removed several days prior to transplanting, and watering should be discontinued to allow the plants to harden off, so that they will be able to get a better start when planted out. A few hours prior to digging up the plants the bed should be given a good soaking, so that the plants may be lifted easily without excessive injury to the roots. The plants should be taken up with a ball of earth adhering to the roots and planted in their permanent positions at about the same depth as that in which they were growing in the seed-beds. The soil should be well-firmed about them and watered thoroughly.

In any lot of seedling plants there is always the possibility of numerous male plants being found and these, of course, are unproductive. Though many methods have been advanced from time to time as

guides to enable male plants to be distinguished from female plants in the seed-bed, there are none unfortunately which can be recommended as infallible. It, however, invariably happens that in the seed-bed a wide variation of vigour in individuals is noticeable. In practice it has been found that the stronger plants almost invariably are males; so that by weeding out these plants and leaving only the weaker specimens there

Plate 208.

Eighteen-months old papaw plant on Major Savage's plantation at Brookfield.

is a reasonable chance of obtaining a big percentage of females. It is not suggested that by following this practice 100 per cent. of females will be secured, and as a further precaution it is recommended that in planting out, two or three plants be planted 2 or 3 inches apart in the one hole and allowed to grow (Plate 209). When the flowers appear the males and unnecessary females can be removed and one female plant

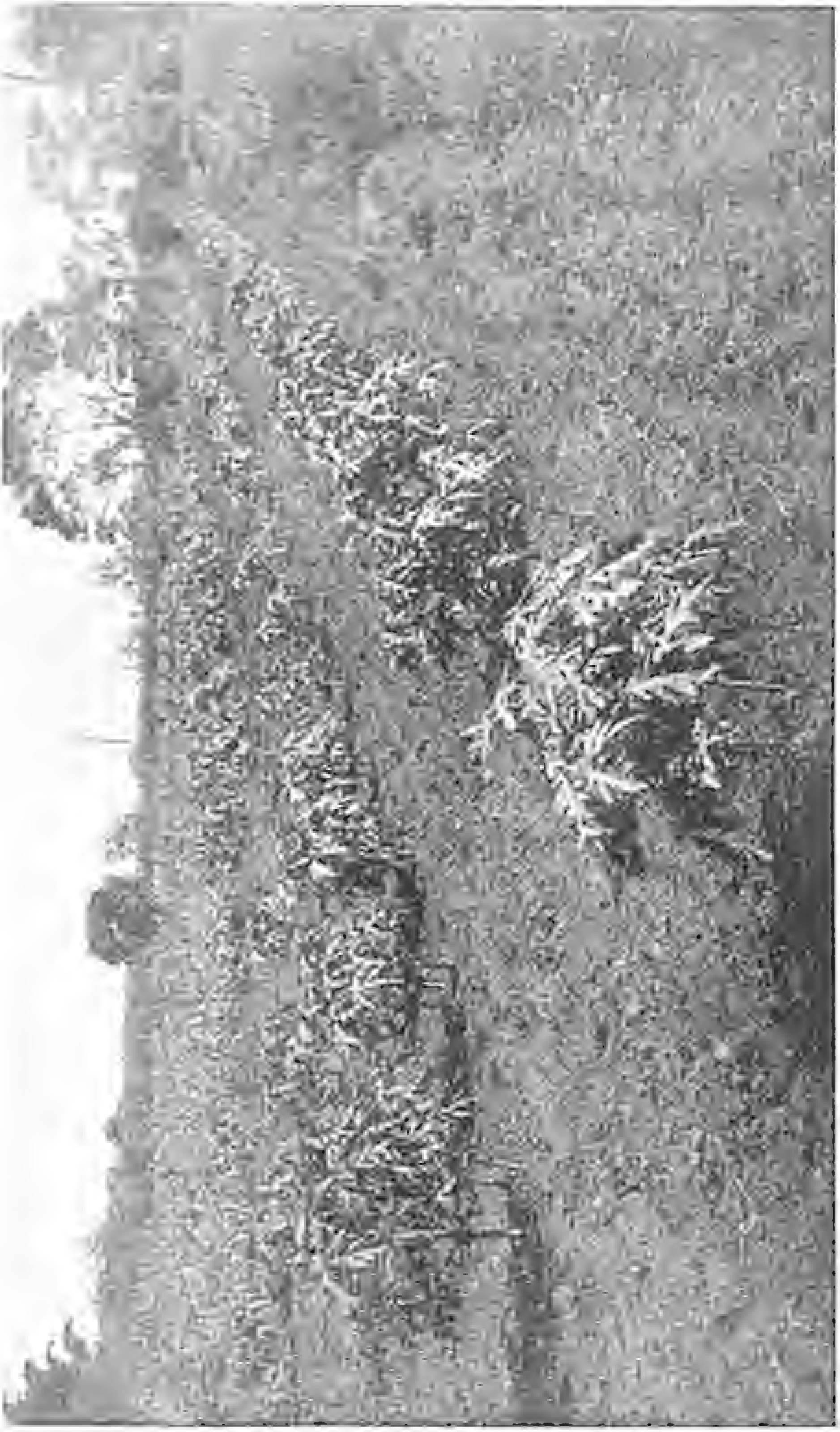


Plate 209.
Young papaw plantation, Sunnybank, showing method of setting three plants in one hole.

left in each hole. About 8 feet by 8 feet permits of 680 plants being planted per acre and is regarded as a reasonable distance apart for planting, as this enables horse cultivation to be carried on between the rows (Plate 210). After planting, however, it is important that cultivation be confined solely to the shallow breaking up of the surface soil.

SOILS AND FERTILIZING.

Whilst the papaw is not essentially a deep-rooted plant, and, provided drainage is good, will grow well on soils which are comparatively not of great depth, it is a heavy feeder, and is therefore partial to a fertile soil. If the soil is not over well supplied with plant foods, the deficiency may be made up by the addition of stable manure where available and the application of artificial manures. The Agricultural Chemist recommends the following fertilizers per acre:—1 cwt. nitrate of soda; 2 cwt. bonedust or Nauru phosphate; 1 cwt. superphosphate; 1 cwt. sulphate of potash—or 1 to 2 lb. of this mixture per tree (Plates 210 and 211).

Part II.

HARVESTING, PACKING, AND MARKETING.

JAS. H. GREGORY, Instructor in Fruit Packing.

GENERAL HARVESTING CONDITIONS.

Climate and temperature, when harvesting is in progress, are big factors in the successful carriage of papaws and other tropical fruits to local and distant markets. Every care must be taken to eliminate carelessness and the rough handling of such delicate fruit. Where possible, when removing fruit from the tree, it should be cut, not pulled. It is essential that fruit after being harvested should be allowed to cool before being packed. This is all the more important if the fruit is to be carried over long distances.

Fruit packed while in a heated condition holds the heat for a long period during transit, thus causing premature ripening or sweating, with the certainty of the consignment opening up in an over-ripe or wet and musty state, which is just the condition favourable to the development of moulds and transit rots. Fruit in this condition has to be sacrificed by the agent to distributing retailers for rapid disposal. Such sales often have a detrimental effect on the price and upon the demand for sound consignments.

By considering the time of the day and picking the fruit while its condition is unheated, precooling is made much easier. If necessary, after picking, the fruit should be spread out in a cool place to reduce its temperature before packing. A flat-topped table with the surface covered with bags or other soft material is just the thing required for cooling, and also will make a good sizing and packing bench.

Care in the selection of the type and condition of fruit for carrying long distances is necessary. Tropical fruits do not ripen satisfactorily under the usual Southern climatic conditions, which lack the warmth and humidity of the Queensland climate. This makes it necessary to allow papaws for those markets to mature on the tree as much as possible before harvesting. During the winter months fruit can be allowed to colour more than in summer without affecting its carrying quality. It is necessary to allow the fruit to hang for the extra period if it is to be supplied to the Southern consumers in the best possible condition.

Plate 210.

Young hillside plantation on Major Savage's property at Brookfield. Note that plants are also set out in groups of three.

Plate 211.
Papaws Growing in a Chinaman's Garden at Redlynch, North Queensland.

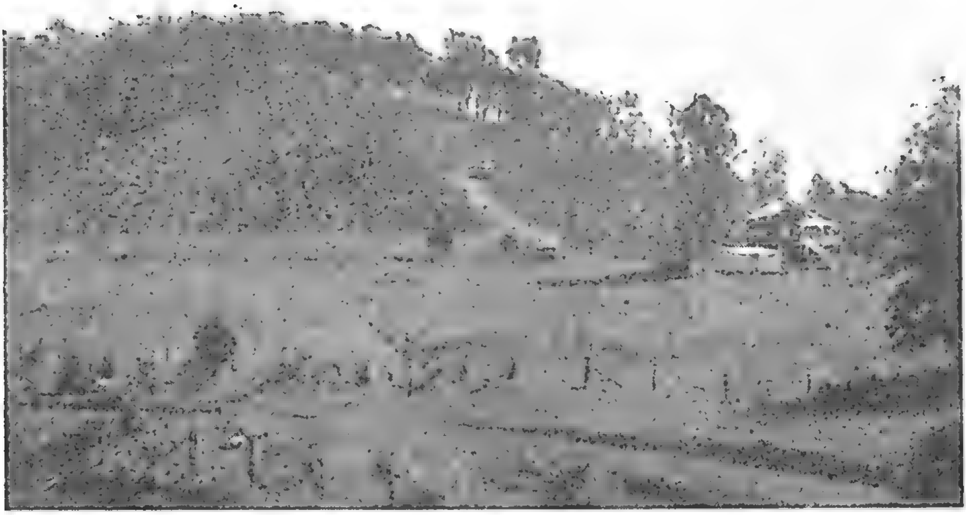


Plate 212.
A Hillside Plantation, Brookfield.

Summer conditions require more care, the fruit not being allowed to advance in colour to the same extent. There appear to be two types of papaws, the one soft-fleshed when ripe, the other firm-fleshed. For average types of soft coloured varieties, the fruit in summer should show one-quarter colour, and in winter one-half. The firmer-fleshed type of papaw can be allowed to colour to an even greater extent before harvesting. Preference should be given to this type of fruit when sending it to distant markets. At the same time, care should be taken not to send the "soapy" type of fruit which never ripens satisfactorily. Removing

Plate 213.
Another Brookfield view of hilly country and planted slopes.

trees which give unsuitable fruit from the plantation is well worth while. Only observation on the part of the grower can determine the actual method to use for his own particular product. No positive method of procedure can be given to growers in this respect, only a general guide, but this, plus the use of common sense, should enable a good product to be placed on the market. Brisbane, Sydney, and Melbourne markets each need slightly different treatment on the lines suggested. The need for placing a first-grade article on the market cannot be stressed too greatly. Queensland growers have the market for tropical fruits completely to themselves, there being no competition from the other States. The importance of these markets therefore can be readily seen. The demand for our tropical fruits is as yet only in its infancy. It should be remembered that the Melbourne and Sydney markets do not want green papaws. Green papaws are unsaleable at any time and usually finish up by being damaged by fungus before they ripen to an extent that renders them only fit for the rubbish tip.

TROPICAL FRUIT CASE.

The best container for the long-distance carriage of papaws is the tropical fruit case, 24¾ inches long by 12 inches wide by 12 inches deep (Plate 214). Woodwool is the most satisfactory packing. The box is prepared by placing a layer of woodwool on the bottom of the case and around the ends and the sides. Each papaw then is wrapped in soft paper or cellophane and placed in a single layer in the prepared box, using small pads of woodwool to separate and make the individual fruit firm and snug. A thin layer of woodwool then is placed over the top of the layer of fruit, and the process is repeated until the case is full, finishing off with a layer of woodwool packing on the top. It is unwise to have the fruit projecting too far above the top of the box, but the lid of the case should press just firmly enough to keep the fruit snug and firm. Packers should avoid placing too much padding in the case; care in matching the various-shaped fruit will greatly assist in this. By using a coloured wrapper in conjunction with the woodwool a very attractive package can be placed on the market. Care in eliminating all green, over-ripe, or diseased fruit when packing is absolutely necessary to ensure safe transit and satisfaction to buyers. Cases when packed should not contain any fruit that will shake about whilst travelling.

PACKING FOR DISTANT MARKETS.

In packing papaws the aim should be to give the maximum protection to the fruit in transit, and to pack the fruit in such a way that it will display to the best advantage when opened and exposed for sale. Before being packed the fruit should be cooled and sized. To assist in making the operation of packing easier, an effort should be made to match the various-shaped papaws whilst sizing them into heaps. Four sizes should be sufficient to cover the packing of papaws for export. As with custard apples, sizing is done easily on a flat-topped table covered with soft bags or other suitable material. Many growers do not think it necessary to go to this trouble, failing to appreciate that the skin of the papaw is exceptionally tender, and that the slightest scratch will cause the fruit to bleed, thus damaging its appearance.

When being sent to Southern markets extremely large sizes of fruit should not be packed, as they are not favoured by buyers. When large fruit is packed and one or two specimens in the cases arrive in faulty condition, it creates a heavy loss such as is not likely to be incurred if only the medium and smaller sizes are used.

When packing papaws for distant markets the maximum protection is given to the fruit by placing the hardest part of the fruit, so far as is possible, to the sides of the case. An examination of a ripe papaw will disclose that the softest part of the fruit is at the opposite end to the stalk. When packing, the soft pointed end of the fruit is protected by placing to the centre of the box, with the stalk end to the outside of the box, where the ill effects of handling are most likely to be felt. With extra large fruit this cannot always be done. Plate No. 214 shows a method that is of assistance in good carriage. Careful attention to these details assists greatly in reducing damage during handling.

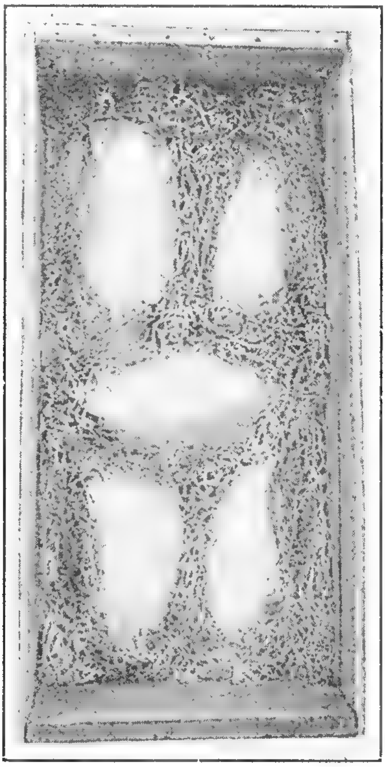


Plate 214.

Large Papaws Packed for Export.—The fruit is wrapped in soft tissue paper and nested in woodwool. The case used is the tropical fruit case, 24¾ in. by 12 in. by 12 in.

Papaws should never be pressed on their sides by thumbs or fingers to ascertain whether they are ripe. A gentle pressure of the hand at the stalk end will reveal the state of ripeness to the experienced packer without damage to the fruit.

PACKING FOR LOCAL MARKETS.

Growers who are near enough to their markets to be able to use motor transport have a decided advantage over those who have to send fruit over long distances. In the former case, the fruit can be left on the tree to become almost fully ripe before being sent to market, and it is not necessary to pack in the same manner as when sending further afield. Close attention should be paid to the elimination of all disease-infected or marked fruit, and sizing also should be rigidly adhered to. The Australian dump case, made in the form of a tray, 18 inches long by 14¼ inches wide by 8⅝ inches deep, is a good container for the local

market (Plate 215). The fruit is packed on end in a single layer resting on a layer of woodwool or similar packing. As a protection against rubbing the bottom end of each fruit, it should be wrapped for about two-thirds of the way in clean, plain white or coloured paper, while each fruit is made snug and tight by pushing pads of woodwool in between the fruit. Papaws packed in this way have a very attractive display value, and sell much more readily than those carelessly placed in cases without packing, the buyer being able to appreciate the quantity and quality at a glance.

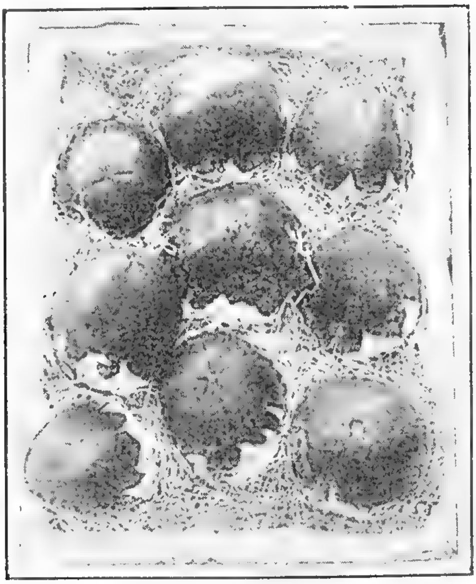


Plate 215.

Papaws Packed for Local Market.—Packed in the Dump Case used as a tray by removing the side; 18 in. long x 14¼ in. wide x 8⅝ in. deep. Note the wood-wool padding between the fruit.

CARE IN MAKING CASES.

Growers, after taking every care in handling their fruit while harvesting and packing, often, through carelessness in making and nailing down cases, offset an advantage already gained by careful handling. Careless nail-driving, causing nails to protrude inside the box from the timber of the case, often results in damaged fruit, with consequent waste. Nail-marked fruit decays, breaks down, and affects adversely the sound fruit in the box. Nails protruding through the outside of a case are a danger to all handling it in transit, often causing bad cuts or loss of temper, and rough handling in consequence. Extra care in such matters is well worth while, and saves trouble.

THE "GET-UP" OF THE PACKAGE.

Attractiveness is the main feature to be studied, as anything added or done to make the produce worth more to the buyer is a big factor in obtaining quick sales and higher prices. The following points are well worthy of consideration:—

Use only clean, well-made cases. Second-hand cases often carry insects and fungus diseases.

Plain white or coloured paper is much more attractive and cleaner than newsprint, while the extra cost is only a fraction of a penny per case.

Where it is necessary to use packing, clean woodwool is preferable to most types of grass and other packing.

Fancy labels are an improvement, but if stencils or rubber-stamps are used care should be taken to apply them neatly and so avoid smudging and spoiling the appearance of the finished package. The packer's full name and address, with the variety and contents of the case, as required by the Fruit and Vegetable Acts, should be embodied in labels or stencils. Cases should always be stencilled or labelled clearly with the name "Papaws." Labels suitably printed can be obtained.

When sending long distances wiring the cases is an improvement, and is an economy and insurance against rough handling. Wiring also is an attraction to the buyer who desires to despatch fruit to distant places.

THE CHOKO.

The choko is a popular vegetable, grown largely in Queensland for both market and home use. It has the advantage that, once planted, it comes into bearing each year from the original root. The plant will die down only during the coldest months, and in the spring will shoot again from the tuber which is formed under the ground.

The choko requires a rich, loamy soil to which has been added a heavy dressing of well-rotted stable manure. Additions of dried blood and bone dust, or of manure during growth, are of great benefit, as, being a perennial and a heavy feeder, the choko's food requirements are considerable.

The method of planting the choko differs a great deal from that used for other varieties of the same family. Whole choko fruits are used as planting material, the growth coming from a shoot from the kernel in the fruit. The fruit should be planted on the side with the broad end sloping downwards and the stem end slightly exposed.

A trellis is essential to satisfactory growth, though, if planted near a fence or old stump, the plants will spread over it very quickly. When chokos are grown commercially it pays to erect a suitable trellis. This may be done with good logs or rough timber. Sometimes an ordinary "T" trellis is used, over which strong fencing wire is stretched.

A good permanent trellis may be constructed as follows:—Two rows of strong posts are set firmly in the ground with a height of about 6 feet 6 inches above the surface, the rows being about 9 feet apart and the posts about 8 feet apart in the rows. The tops of the posts support cross timbers on which strong fencing wire is stretched with about 18 inches between the wires to carry the vines. Stays support the outside posts, and wires for trellising also should be stretched upon these.

The choko takes some months to come into full bearing, but will commence to bear fruit generally some four to five months after planting. The plants appear to improve with age when properly cultivated and manured.

There are two varieties, the green and the cream. The cream-coloured variety is the more popular.

Chokos should be picked fresh and, after having been peeled, should be cut into suitable portions and boiled or baked.

—*C. N. Morgan.*

Tomatoes in the Central District.

W. J. S. SLOAN, B.Sc.Agr., and W. J. ROSS.

WITH the higher level of prices which usually operates from September to December, the tomato crop assumes greater importance to the farmers in the tomato-growing areas of the Central district. This period coincides with an increased incidence of pest and disease troubles. Particular attention, therefore, should be paid to the cultural requirements of the plants and to pest and disease control in order to prolong the bearing period.

Normally with tomato patches on scrub burns, weeds do not trouble the young crop unduly; but it is advisable to check the weed growth which sometimes becomes serious at picking time. The soil around the base of the plants should be kept loose, at the same time, with the hoe. In cultivated areas, the land should be kept well stirred and free of weeds, which both rob the soil of valuable moisture and encourage the breeding of pests such as the corn-ear worm and the tomato mite.

Old plants may be cut back profitably if the root systems are reasonably sound and a bunch of fresh growth is shooting from the main stem. If excessive, this flush of new shoots may be thinned lightly. Severe thinning is undesirable, as it is necessary to retain sufficient foliage to keep a reasonable balance between the root system and the parts of the plant above the surface.

A handful of a 4:11:10 chemical fertilizer, containing sulphate of ammonia, superphosphate, and sulphate of potash, should be applied to old plants and backward young plants, in order to stimulate new growth and blossoming. When the first fruit has set, a dressing of 50-60 lb. of sulphate of ammonia per acre will help to keep the plants moving.

Tomato mites spread rapidly as the warm weather approaches, and quickly cause a dying-back of the foliage from the centre of the plant. Loss of foliage exposes the stems and the fruit to the hot sun with harmful results. For the control of the mite the plants may be sprayed with lime sulphur at a strength of one in eighty. Alternatively, a dust composed of flowers of sulphur and a good quality hydrated lime in the proportion of 1: 1 can be used. If mites already are numerous on the plants, spraying is preferable to the dusting. However, if the plants are treated with a sulphur-lime dust from the seed-bed onwards, a satisfactory control of the mites will be obtained.

Damage by the corn-ear worm also increases rapidly in the spring, and may be the cause of heavy losses of fruit if not checked at an early stage. Lead arsenate is the most reliable insecticide for this pest, and may be used as a spray or dust. A suitable spray can be prepared by adding 3 lb. of lead arsenate to 100 gallons of water and including a spreading agent. If mites are troublesome at the same time, colloidal sulphur may be included with the lead arsenate. As a dust, the lead arsenate is used diluted 1: 1 with either a good quality hydrated lime or sulphur, the latter diluent having the additional advantage of controlling the mite.

Lead arsenate leaves an objectionable spray residue, and should not be used after the plants have commenced to fruit. Constant attention to the control of the corn-ear worm up to this stage, however, gives an excellent chance of a reasonable crop.

Leaf diseases and black spot on the fruit frequently appear as the plants age and lose their vitaility. Correct manuring, cultivation and pest control all help considerably to prolong the life of the plant.

When a fungicide is necessary, either a Bordeaux spray or a copper dust may be used to hold the diseases in check. To control pests and diseases with a combination spray, lead arsenate and a colloidal sulphur preparation may be added to the Bordeaux. Lime sulphur cannot be included in sprays containing either lead arsenate or Bordeaux, as such mixtures are liable to injure the plants.

Various proprietary dust mixtures containing lead arsenate, sulphur and a copper compound are marketed for the purpose of controlling pests and diseases in one operation.

THE EGG PLANT.

The egg plant is easily grown and produces an excellent culinary vegetable. It is grown similarly to the tomato, and like that plant is very sensitive to cold. It requires a light, rich, loamy, well-drained soil, and poorer ground may be improved by the addition of a 1-4-1 mixture of sulphate of ammonia, superphosphate, and sulphate of potash at the rate of about 5 cwt. to the acre, or by heavy dressings of well-rotted stable manure to which a small quantity of superphosphate has been added.

For an early crop the seed may be sown under cover during July and August; and, when all danger of frost is over, the plants should be set out about 2 feet apart in rows 3 feet apart. Difficulty may be experienced with transplanting, and, it is sometimes desirable to sow the seed in the permanent positions for the plants after all danger of cold weather has passed.

Cultivation and plenty of water are necessary for the plants, as they do not recover readily after a check in growth. Staking in a similar manner to tomatoes may be practised, while, as soon as the fruits are formed, they should be thinned out to leave only eight or ten to each plant. The fruits are harvested when from 4 to 6 inches in diameter. The time from seed planting to transplanting is approximately two months, and from seed planting to mature fruit five months. The best variety is the New York Purple Spineless.

For cooking the fruit should be cut into slices and fried in batter, the slices having been covered first with salt. If being boiled or baked, the fruit should be seasoned with butter, pepper, and salt.

—*C. N. Morgan.*

PRUNING GRAPE VINES TO AVOID INJURY BY SPRING FROSTS.

Spring frosts occasionally cause considerable damage to vineyards, especially in the inland areas of high altitude. Vines which are the first to come into leaf naturally suffer most, as the dormant vines are injured only in exceptionally extreme cold. Many cases have been brought under notice where the entire crop of a vineyard has been ruined overnight by one late frost, while an adjoining area, in which the vines had not commenced to sprout, has been quite unharmed.

Vines that have been pruned in the late autumn and early winter are the first to come into leaf, and naturally are more susceptible to injury by frost than those pruned in the late winter or early spring.

Many vignerons practise early pruning, the desire being, no doubt, to have the job finished and so leave themselves free for other work. It is true that late pruning comes often at an inopportune time, conflicting with other spring work on the farm; but where a grower is considering his income he must, if at all possible, arrange pruning operations to minimise frost injury to his vines.

The work can be simplified to a great extent by a modification of the usual practice by which the pruning is carried through in one operation. Instead of completing the pruning by mid-August, which, for instance, would be a wise procedure in the Stanthorpe district, a preliminary pruning could be made in June, which would consist of shortening the canes back roughly to, say, nine eyes above the main arm or spur, and removing the prunings from the land. Then, just before the buds commence to swell in the spring, the rods that have been left on the vines can be shortened back to the required length.

Young vines that have been budded in the previous summer should never be pruned early, for, being close to the ground, the young growth is much more susceptible to injury than that of more mature vines higher up on the trellis wires.

—*F. L. Jardine.*

Cucumber-growing.

C. N. MORGAN, Fruit Branch.

THE warmth of the climate makes this crop a very suitable one for Queensland. In the coastal and northern districts several crops can be grown during the season.

Planting is carried out usually in the southern coastal districts from September to January, and on the tablelands from October to January; in the northern districts, on the coastal areas from July to January, and on the tableland and inland areas from August to January.

The Agricultural Chemist, in his pamphlet on "Complete Fertilizers," states: Cucumbers may be grown on almost any soil so long as it is fairly light and loamy and plenty of manure is added. The pits or hills should be prepared by mixing a large amount of well-rotted stable manure, sheep or fowl dung, ashes, and bonedust with the soil. Apply in addition the following artificial fertilizer:—

> 1½ cwt. sulphate of ammonia or nitrate of soda;
>
> 3 to 4 cwt. Nauru phosphate—superphosphate mixture;
>
> 1 to 1½ cwt. sulphate of potash;

or 6 to 8 cwt. of a 5-12-5 mixed fertilizer per acre, or 2 to 3 oz. of the same mixture per square yard.

The terms "pits" or "hills" are used to represent groups of four or five plants. At one time the seed was sown always on hills raised above the ground level, but unless the ground is badly drained this practice need not be followed.

Four or five plants are sufficient to a "hill," and the seeds should be placed 3 or 4 inches apart and about 1 inch below the surface. The "hills" should be about 4 feet apart each way, and the whole surface left loosely cultivated.

Should the plants send out their runners to a distance of 2 or 3 feet without setting cucumbers, fruiting may often be induced by pinching out the tips of the runners.

Cucumbers should be harvested when nearly full grown, before the seeds harden and the skin begins to turn yellow.

The time from planting to harvesting is usually about three months, and 1 lb. of seed set out as directed will plant an acre.

The varieties recommended are: For market purposes, Imperial White Spine; for pickling, Early Green Cluster.

THE FARM ORCHARD.

Where there are young children in a family particularly a good supply of fresh fruit and vegetables is a necessity, if there health is to be maintained. Even if some expense is involved in making a farm orchard garden, it is well worth the cost. A well-kept garden, and a home surrounded by trees is a decided asset to any farm, and undoubtedly enhances its value.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

CONTINUOUS dry weather is still causing complications in the marketing of fruit. High prices have been maintained for many fruits, but a drop will soon ensue if growers do not cease sending small poor-quality fruit.

The price for bananas has reached the highest level for many seasons, but growers may expect a sharp decline in the near future if the practice of marketing immature fruit is allowed to continue. Thin, angled fruit is never in demand and slows up sales, causing an accumulation of stocks with a consequent price easement for all lines.

Growers are reminded, too, that cutting fruit too soon has the effect of greatly reducing the ultimate output of the plantation. Certainly at this period of the year most plantations will have a proportion of bunches that have fallen out or have had to be harvested from dead stools, but at the same time this does not give the right for a consignment to be composed completely of immature, angled fruit. In the last few weeks many consignments have been condemned for this fault.

Many reports of the incidence of "squirter" have been received. Squirter and black-end can be practically eliminated by the adoption of cluster packing. It is well to remember that it is the grower who pays for all faults noticeable on the market, not the agent.

Pineapple quality has improved, less green fruit being noticed, and values have remained steady but at lower levels than a few weeks ago. Growers are advised to cut all fruit for distant markets.

With the approach of the warmer weather consignments of papaws will have to be watched more closely, and care in the selection of firm, coloured fruit will need to be exercised. Summer consignments should not show more than about one-third colour for most types. Unfortunately, no fixed rule can be given, since papaws vary in type—some being highly coloured and some green when ripe. There also are apparently both hard and soft types. Consignors to Southern markets are urged to study their plantations and select the trees which produce the best types of fruit for distant carriage. Remember that the taste for tropical fruits has still to be developed in the Southern States. As Queensland has the means for unlimited production of these fruits with no competition to meet, it is all in our interests to foster this trade.

Southern apples are giving trouble on the Brisbane market. Southern shippers should realise that the weather in Queensland is now becoming warmer, and that apples sent from cold stores in the cooler Southern climates do not hold long in good condition in Queensland at this time of the year Only varieties such as Yates and Tasma should now be sent. Jonathans and Sturmers of any size will inevitably cause trouble and loss.

Market prices for the month:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Eights and nines, 17s. to 21s. per case. Sevens, 11s. to 19s. 6d. per case. Sixes, 12s. 9d. to 17s. 6d. per case. Smalls, 9s. to 15s. 6d. per case.

Sydney.—Eights and nines, 22s. to 24s. per case. Sevens, 19s. to 22s per case. Sixes, 15s. to 19s. per case. Thin fruit hard to move.

Melbourne.—Eights and nines, 23s. to 24s. per case. Sevens, 21s. to 22s. per case. Sixes, 19s. to 20s. per case. Thin fruit slow of sale.

Pineapples.

Brisbane.—Smooths, 5s. to 8s. per case; loose, 1s. 6d. to 7s. per dozen. Ripleys, 8s. to 11s. per case; loose, 2s. to 7s. per dozen.

Sydney.—Smooths, 8s. to 11s. per tropical case.

Melbourne.—Smooths, 8s. to 10s. per tropical case; a few special lines higher.

Papaws.

Brisbane.—Yarwun, 7s. to 11s. per tropical case; locals, 2s. 6d. to 6s. per bushel case; Gunalda, 5s. to 6s. per bushel case.

Sydney.—10s. to 13s. per tropical case.

Melbourne.—10s. to 14s. per tropical case.

Mangoes.

Mangoes have made their appearance on the market. Many consignments give the appearance of having been harvested with a stick, shillings a case being lost in the price.

Brisbane.—7s. to 8s. per case; inferior, bruised, and soft fruit lower.

Passion Fruit.

Brisbane.—6s. to 12s. per half-bushel; specials, to 14s.

Sydney.—6s. to 9s. per case; inferior fruit hard of sale.

Melbourne.—4s. to 12s.; specials higher.

Strawberries.

Brisbane.—4s. to 6s. per dozen boxes; specials, to 9s.

Sydney.—Trays, 3s. to 5s. each; boxes, 9s. to 12s. per dozen.

CITRUS FRUITS.

Oranges.

Brisbane.—Valencias, 5s. to 8s. 6d. per bushel; second crop, 4s. to 5s. per bushel; Gayndah district, 9s. to 10s. per bushel.

Sydney.—Valencias, 4s. to 7s. per bushel.

Melbourne.—Navels, 6s. to 8s. per bushel; commons, to 10s. for specials.

Lemons.

Brisbane.—Locals, 4s. to 8s. per case; Gayndah, 8s. to 13s. per case.

Sydney.—Locals, 3s. to 6s. per case.

Melbourne.—4s. to 7s. per case.

Grape Fruit.

Brisbane.—4s. to 9s. a bushel.

Sydney.—4s. to 10s. a bushel.

Melbourne.—6s. to 12s.; specials higher.

Mandarins.

Brisbane.—King of Siam, 5s. to 8s.; Waratah, 5s. to 12s. Other varieties and small fruit hard to sell.

Apples.

Brisbane.—Jonathan, 6s. to 9s.; Granny Smith, 5s. to 9s.; Sturmer, 4s. to 7s.; French Crab, 5s. to 7s.; Crofton, 7s. to 10s.; Yates, 5s. to 9s. Many lines are not holding well, particularly the softer varieties.

Pears.

Brisbane.—Coles, 9s. to 15s. per bushel; Nelis, 7s. to 12s. per bushel; Josephine, 9s. to 13s. per bushel.

All pears should be wrapped and handled as little as possible when packing, as at present a strong tendency to go specky is noticeable.

Custard apples and avacadoes are now off the market.

OTHER FRUITS.

Cape Gooseberries.

5d. to 7d. per lb.

Tomatoes.

Brisbane.—Good, ripe 7s. to 9s. per half-bushel; inferior, down to 4s. per half-bushel; green matured, 4s. to 10s. per half-bushel; coloured, to 12s. per half-bushel.

Sydney.—Yarwun, to 10s. per half-bushel; Bowen, 6s. to 10s. per half-bushel; Southern Queensland, 12s. to 13s. per half-bushel.

Bowen growers would do better if packing in the dump half-bushel case were adopted.

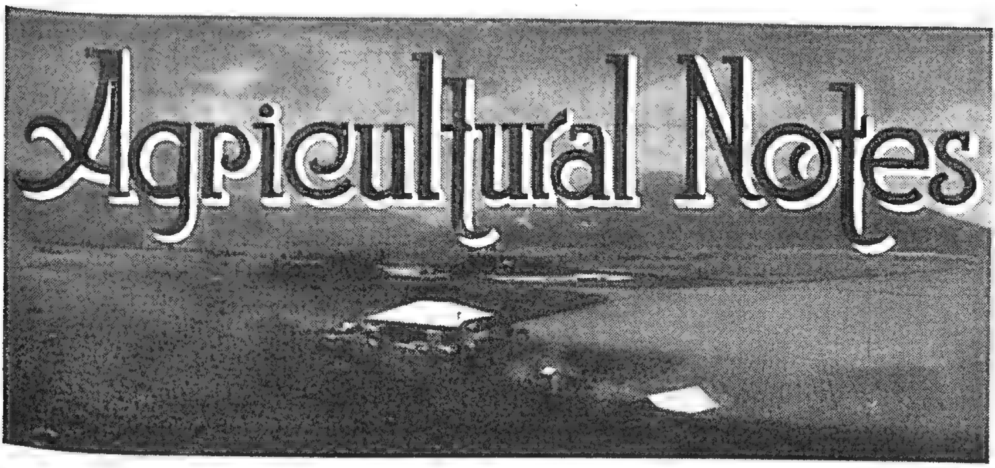
Melbourne.—Adelaide Hothouse, 18s. to 22s. per half--bushel; West Australian, 12s. to 18s. per half-bushel.

Vegetables.

Brisbane.—Beans: 4s. to 6s. a sugar bag. Peas: 4s to 6s a sugar bag Lettuce: 6d. to 1s. 3d. dozen. Cucumbers: Bowen, 5s. to 7s. per bushel; locals, 4s. to 11s. per bushel.

Publication.

"Strawberry Packing" is now available for distribution.



Seasonal Sowings.

C. J. McKEON, Director of Agriculture.

LAND prepared for summer-growing crops can be sown now with a variety of fodder, hay, and grain crops—such as maize, sorghum, millet, Sudan grass, and cowpeas. The majority of farmers recognise fully the necessity for making provision for recurring dry spells, and also for the winter months, when the growth of natural pastures is retarded considerably. In favourable seasons good results can be obtained by the cultivation of winter cereals and legumes; but it is to the more vigorous growing summer crops that stockowners must look for the provision of their chief requirements in hay, fodder, and silage.

MAIZE.

Maize can be grown successfully on a great variety of soils within the 30-inch rainfall region, deep alluvial soils being particularly suitable for its full development. Land ploughed deeply during the winter should be in good condition just now as a result of cross ploughing and harrowing; and it is well to remember that no amount of inter-row cultivation will undo the effects of sowing on hastily prepared land.

Maize crops usually are termed early or late, but as sowings may take place from August to late December, no definite sowing period can be recommended, weather conditions being the governing factor.

For grain purposes, the chief essential is to assure adequate moisture during the tasselling stage. Nine to 10 lb. of sound seed to the acre will be found sufficient, sowing in rows 3 feet 6 inches to 4 feet apart; but for fodder or silage purposes double this quantity may be used, choosing a leafy variety such as Reid's Yellow Dent.

SORGHUMS.

The sweet or saccharine sorghums also are widely grown throughout the dairying districts, as they provide a large bulk of nutritious and palatable fodder.

Although slightly less nitritious than maize, the sorghums will withstand dry conditions much better, while they also retain their

succulence for a period after maturity, making them specially valuable as early winter feed. In cultural requirements the crop is somewhat akin to maize, sowing being done in rows 3 feet to 3 feet 6 inches apart, which will be found to utilise approximately 5 lb. seed per acre. Sorghums frequently are sown broadcast; but although a finer stalk is produced, the total yield is reduced often by this method, besides which, weed growth is apt to be troublesome during the early stages of growth.

For silage purposes sorghum should be cut when the grain is well formed yet still in the soft dough stage. Saccaline, Imphee and White African are popular varieties.

MILLETS.

Where a quick-growing summer grazing or hay crop is desired, the millets can be recommended confidently, as they will produce fair crops even on the poorer soils.

The seed usually is drilled or sown broadcast, at the rate of 12 to 15 lb. per acre, and under favourable conditions the resulting crop will provide good grazing within five or six weeks. However, it is preferable to exclude stock until the plants are 8 inches to 9 inches high, when the roots will have a sufficiently strong hold to withstand grazing.

For hay purposes millets should be cut when the grain is in the soft, doughy stage; and, if a binder is used, small sheaves should be made and stooked in windrows. The varieties known as Japanese millet and white panicum have given the best results.

SUDAN GRASS.

Sudan grass also is excellent for grazing or silage purposes, and is considered to be the best possible summer crop for the drier farming areas, such as the Western Downs and Maranoa.

It is better to drill in the seed, using approximately 8 lb. per acre; but for broadcasting double the quantity will be required. The risk incurred in allowing stock access to Sudan grass prior to the flowering stage has been stressed often; however, the risk is taken by many experienced stockowners who have fed the crop during all stages of growth without ill-effects. Sudan grass and other members of the sorghum family cross fertilize readily, and the resultant hybrids are likely to cause poisoning; consequently, care should be taken to obtain pure seed from a reliable source.

COWPEA.

The cowpea now is widely recognised as a valuable green manure crop, resulting in the development of a good trade in locally-grown seed. Its profitable utilisation as a fodder crop is also receiving attention by progressive dairymen, as it is highly nutritious, provides a good bulk of fodder, and is valuable as a rotation crop. Stock can be readily accustomed to green cowpea by sowing in conjunction with maize, either in the maize drills or in alternate rows. The seed varies greatly in size according to variety; so that, when sown in drills 3 feet apart, from 5 to 15 lb. seed per acre will be necessary. Poona, groit, black, and brabham are popular varieties.

With all spring-sown crops much better results are obtained when inter-row cultivation is carried out thoroughly, although, as previously pointed out, the initial preparation of the land, involving winter fallow, is of primary importance.

Cutworms in Seedling Cotton.

W. J. S. SLOAN, B.Sc.Agr., Assistant Research Officer.

DURING the spring and early summer months one of the most serious pests of seedling cotton with which the farmer has to contend is the common cutworm.

In years of cutworm outbreaks the loss of stand may necessitate replanting. Replanting is successful only when the soil contains adequate soil moisture, and some time may elapse between a cutworm outbreak and the resowing. Late replant crops are rarely so successful as those sown early, and for that reason precautions should be taken against cutworms to ensure a commercial stand of cotton with the first seeding.

The winter of 1937 has been more or less favourable for the insect, and it is possible that good spring rains will be followed by a widespread emergence of moths. Farmers therefore should be familiar with the habits of the pest and the methods used for its control.

The cutworm—the larva of a dark-brown moth—is a stout, soft-bodied greyish-brown to greyish-green caterpillar growing up to 1½ inches in length, which feeds principally on low-growing weeds. When these food supplies are disturbed in any way, the caterpillars may migrate to nearby cotton fields or, if already in the paddock, may damage the germinated cotton. The pest feeds at night and normally attacks the stem just above the ground level.

Cutworm losses in cotton may be considerably reduced by a good cultural system. Thorough ploughing, in which weeds are destroyed completely, is necessary. Patches of weeds missed during ploughing frequently are the centre from which extensive cutworm damage may radiate. Ploughed land should be kept free of weeds for at least a month before the planting, which, if the rains are suitable, will be carried out between mid-September and mid-October. Early ploughing is therefore required. After planting, weeds should be kept in check.

If weeds are ploughed under immediately prior to planting, the risk of cutworm injury is increased greatly, for many of the eggs and larvæ on the weeds will survive and attack the cotton seedlings.

Virgin land, or Rhodes grass paddocks which are being prepared for cotton, usually contain little weed growth, and this, to a great extent, minimises the risk of cutworm injury. Under these conditions, a later planting may be made without incurring severe seedling losses. Even in these cases, however, early ploughing is preferable, in order to ensure the preparation of a good seed-bed, and to allow adequate time for the organic matter to break down.

Where direct control of the cutworms is required, insecticides must be used. The poisoned bran bait method has been tested thoroughly, and is recommended as a reliable control measure.

To prevent the entry of invading swarms, the use of one or more baited furrows is necessary. When the pest is within the field, the bait may be broadcast or applied in lines along the rows of cotton seedlings. If broadcast, about 50 lb. dry weight of bran will be required per acre; if distributed along the rows, 25-30 lb. dry weight of bran per acre should be sufficient for baiting purposes. The formula of the poison

bran bait is as follows:—25 lb. bran, 1 lb. Paris green, 2 quarts of molasses, and enough water (2-2½ gallons) to make a friable, crumbly mash which can be broadcast without difficulty. The bran and Paris green are first mixed dry; the molasses is dissolved in the water, and after being mixed the whole is well stirred up to make the mash as required. As the cutworms are night feeders, the bait should be applied in the late afternoon and evening. The use of insecticides for cutworms is a remedial measure only, and is not necessary, normally, if efficient cultural practices are applied on the farm.

THE CULTIVATION OF GRAIN SORGHUMS.

During the past two years climatic conditions prevailing in Southern Queensland have not favoured maize production, particularly on the Darling Downs and on farm lands west of the Main Range. The production of grain sorghum as an alternative to maize in the drier farming areas, therefore, is well worth consideration when planning cropping programmes. There is no doubt that suitable varieties of grain sorghums will yield profitably under seasonal conditions which are usually unsuitable for maize grain production.

Friable medium to heavy loams will produce the heaviest yields, but satisfactory crops can be grown on average wheat lands throughout the Darling Downs, Maranoa, and the agricultural districts of Central Queensland. The best results are obtained from thoroughly cultivated winter fallowed land.

Grain sorghums may be sown through standard grain drills, either in rows 3 feet to 4 feet apart, permitting of inter-row cultivation, or through every grain run or every second grain run of wheat drills. When sown in the wide spaced rows, 4 to 5 lb. of seed per acre are usually necessary, although satisfactory stands have been obtained with a seeding rate as low as 3 lb. per acre.

Of the tall-growing varieties Feterita and Standard Milo have given the best results, Blackhull, Kafir, and White Milo also being satisfactory types.

For large-scale production of such varieties it is necessary as a rule to harvest with a maize binder prior to curing, carting, and threshing.

Small areas can be headed with a cane knife and carted direct to the barn, subsequently passing the heads through a thresher or corn sheller suitably adjusted for the purpose.

The dwarf-growing varieties, however, offer the greatest opportunity for economical production within the wheat areas, as harvesting can be undertaken successfully with header-harvesters, reaper-threshers or auto-headers.

During the 1936-37 season, when maize crops on the Downs failed generally, small areas of Wheatland, Milo, Brown Yolo, Kalo, Day Milo, and Dwarf Pink produced marketable grain, the yields varying from approximately 6 to 50 bushels per acre, according to seasonal conditions in the district concerned, three growers harvesting with standard grain harvesting machinery. As grain sorghums can be relied on to produce heavier yields than maize during any season, the fact that machine harvesting is now possible should greatly enhance their popularity.

In some districts bird pests are very troublesome; but with increased areas these probably would prove less serious.

Regarding food value, the grain sorghums are little inferior to maize. Feeding tests carried out in the United States of America have indicated that grain sorghums had approximately 90 to 95 per cent. of the feeding value of maize for fattening cattle, pigs, and lambs. The protein content of grain sorghums is higher generally than that of maize.

Seed supplies of the dwarf-growing varieties are very limited, the stocks previously held by the Department of Agriculture now being exhausted.

However, it may still be possible to secure seed from growers on the Darling Downs and in the Rockhampton district. Inquiries should therefore be directed to the offices of the Department of Agriculture and Stock at either Toowoomba or Rockhampton.

The Sweet Potato.

N. E. GOODCHILD, Senior Instructor in Agriculture.

THE sweet potato is not cultivated in Queensland to-day to the extent that its usefulness warrants. At one time it was used largely on the householder's table, but now it is a rarity.

When questioned about the shortage of sweet potatoes for table use, the farmer usually replies, "There is no demand for them." This is true only in part, as there is still a demand for the right varieties. A dry floury, or a moderately moist, potato will suit the consumer best. No doubt, some of the good varieties in use in the past are not now available, because of droughts and irregular planting, but many are still grown in certain localities. If the planting is confined to varieties which have proved popular with the consumer, and which could be sold on name, the demand for them should be continuous. Under present conditions a householder may buy sweet potatoes which are unpalatable. If, however, consumers realised that there were different types and varieties of sweet potatoes, they would learn to purchase only those varieties suitable for culinary purposes.

Market gardeners should, therefore, cultivate varieties for which they could readily find buyers, as some are already doing with good results. Very watery or stringy varieties are both undesirable. It is a mistake for a grower to allow a portion of his crop to stand over after maturing, as the tubers then begin to deteriorate in quality.

The sweet potato is a hardy, vigorous grower, but prefers deep sandy loam soils, as the texture of the soil affects the form, size, and smoothness of the potato. The period of planting is dependent very largely on the locality; in most parts along the coast it may extend from October until the end of February, the tubers being ready to lift within three to four months after planting. The crop must mature before the frost commences. It does not require a heavy rainfall—in fact, excessive moisture is detrimental, in that it increases the growth of vines, and lessens the development of tubers.

The most satisfactory method is to plant a few medium-sized tubers in a nursery-bed of good friable soil, which is mulched in order to retain moisture and promote rapid growth, and to pick slips or cuttings as growth progresses. A bed of fifty selected tubers planted in this way will provide many thousands of cuttings. The alternative, and less satisfactory, method of obtaining planting material is to procure cuttings from an old plot, which is usually neglected. The terminal cutting from the vine is generally regarded as giving the best results. The land is set up in ridges 3 feet apart. The cuttings should be 12 to 15 inches in length, and planted on the ridge to a depth of approximately 6 inches, cuttings to be set from 20 to 24 inches apart. On well-prepared soil weeds should not be troublesome, shallow cultivation being sufficient until the runners commence to cover the ground.

A classification of all varieties grown in Australia was carried out in recent years by an officer of the Department of Agriculture and Stock, and cuttings of a known type, together with a number of new seedling varieties, were distributed in different agricultural districts

of the State. Some recommended varieties for planting for table use are Gold Coin, Seedling No. 3, Brook's Gem, and Snow Queen—which are obtainable in the Rockhampton district—and Porto Rica, Market, Red, Director, and Farmers' Special, which are obtainable more readily in the southern districts.

It is advantageous to the grower to market the tubers in a clean and attractive condition.

GRADING OF ONIONS.

Onion harvesting generally will commence in October. Flavour, size, firmness of texture, and capacity to carry well without serious bruising or other damage all influence their market value.

Buyers, however, sometimes complain of onions being marketed without due regard to their classification in accordance with the size of the bulbs. It is the custom of some growers to include large and small sized onions in the same bag. This practice is against the interests of the farmer, contrary to the wishes of the selling agents, and results in comparatively lower realisations on the market.

Onions should be classified according to their size. The small sized onions, say, below 2 inches in diameter, should represent one "size" grade. Onions ranging from 2 inches to less than 3 inches in diameter should comprise another grade, and onions from 3 inches to 4 inches in diameter should form a further grade.

Some growers prefer to classify the onions in grades in accordance with each ½-inch increase in diameter. This practice results in the onions in each grade being very even and uniform in appearance.

The number of grade classifications should be determined by the variation that occurs in the size of the individual bulbs comprising the crop. In ordinary circumstances, the classification of the bulbs into three or four grades will suffice. It is important, however, that the onions should be graded as evenly as practicable. All "outsized" bulbs, especially the onions that are coarse, and are customarily referred to as "bull-necks," should be rejected.

WHAT IS SUCCESS IN FARMING?

The successful farmer is often spoken of, and so the question arises naturally: What is success in farming? Most people without practical experience will say that is very easy to answer. From experience it is known that the longer the calling of farming and stockbreeding is practised the more it is realised that success in agriculture and other land industries is not so simple as it looks.

To one man, success will mean the winning of a prize at the Brisbane or district show; to another it means having the best kept farm for miles around; to yet another success will be assured when the mortgage is lifted. Many may dream of the day when they can lie in bed with tea and toast in hand listening to the cows being yarded; or spread out in a squatter's chair on the veranda watching ripe apples falling into the basket.

However, when the business of farming is looked at in its true perspective it becomes plain that some men on the land have no definite aim. Farming is such a long-term job that, to get any real measure of satisfaction it is necessary—and would pay handsomely—to decide on a general policy and stick to it.

Difficulties are often due to lack of a definite policy—planning of the work and working to the plan—and the great attraction in agriculture is that it gives so much room for initiative and success. If initiative is lost much of the joy will soon go out of work on the land.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the advanced register of the herd books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Friesian Cattle Society, production charts for which were compiled during the month of August, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORN.				
MATURE COW, (STANDARD 350 LB.).				
Model 3rd of Alfa Vale (365 days)	W. H. Thompson, Nanango	18,733·9	835·071	Reward of Fairfield
SENIOR, 2 YEARS, (STANDARD 250 LB.).				
Sunnyview Gaiety	J. Phillips, Sunnyview, Wondai	13,938·6	454·262	Burradale Byron
JUNIOR, 2 YEARS, (STANDARD 230 LB.).				
Rosenthal Roseleaf 17th (246 days)	M. C. and A. M. Sullivan, Pittsworth	6,502·52	268·048	Rosenthal Carbine
Sunnyview Princess 3rd	Burnett Brothers, Brookfield	7,283·2	267·64	Burradale Byron
College Molly 5th	Queensland Agricultural High School and College, Gatton	6,143·76	231·237	College Butterman
JERSEY.				
JUNIOR, 2 YEARS, (STANDARD 230 LB.).				
Bluebell of Peeramon	O. H. O. Koppen, Peeramon	4,924·6	293·3	Trinity Sagunda's Prince
Bellgarth Birthday III.	D. R. Hutton, Cunningham	5,339·97	277·413	Airlie Thorn
Limelight of Peeramon	O. H. O. Koppen, Peeramon	4,742·85	231·644	Trinity Sagunda's Prince
FRIESIAN.				
JUNIOR, 2 YEARS, (STANDARD 230 LB.).				
Arcadia's Queen Zara	F. C. Noller, Kumbia	6,375·7	252·739	Ryfield Sultan 2nd.

The Tropics and Man

Effects on the Nervous System.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology, University of Queensland.

Second Series: No. 3.

IN the last two articles the words "nervous system" have cropped up several times. By devious channels this section of the body's machinery seems to come in for special attack by the various factors of tropical climate. So true is this, and so important the results, that it seems advisable to consider it a little more fully here.

Development of the Brain.

The lowest animals have no nervous system. The different parts are so close together and the animal's structure is so simple that a nervous system is of no more use to it than telephones would be in a small store. Animals slightly higher in complexity have a nerve net, just as an office may have a simple telephone system without a switchboard. In a large factory, such a simple net would be cumbersome and inefficient, so a central switchboard is installed. Just so do the next higher animals develop the most forward part of their nervous system as a brain. This brain becomes more and more highly developed as the animal's complexity increases until the incredibly complicated nervous system of man is obtained to the despair alike of the medical student and the sufferer from neurasthenia.

The nervous system is at once the most delicate, the most complex, and the most essential system that man possesses. For these reasons it bears the brunt of every-day stresses, and if disturbed, involves the body in the most important consequences (e.g. a motor car smash after three whiskies). Scientists investigating the electrical changes in nerve cells had to invent apparatus so delicate that it was disturbed by the compression of the air in the room when a gust of wind blew against the wall of the closed building. That may give you some idea of the incredibly delicate nature of the nerve cell. Yet the smallest variation in these processes means a huge alteration in the efficiency of the nerve cell. If we once realise that, the wonder is, not that our surroundings affect the nervous functions, but that we can live at all. The most delicate instrument made is the crudest toy as compared to the nerve cell.

Control of Body Temperature.

We saw in an earlier article that the main purpose of the body's behaviour when placed in hot surroundings is to keep the body's temperature constant, or at least within a certain harmless range. This may at times be possible without interfering unduly with body function; at others, some sacrifices may have to be made; at others, it may be quite impossible, no matter what sacrifices are made by the different systems. In all these adjustments, the nervous sytem, as befits its nature, has many duties to perform. Through its activities the sweat glands are called into action, the skin blood vessels dilated, extra fluid

thrown into the circulation, and muscular relaxation increased—all measures designed to increase loss of heat from the body or diminish its production within the body. The decreased desire for physical work is also protective, and, in a way, a function of the nervous tissue. Certain of the ductless glands, particularly the suprarenal medulla, are under nervous control and have to be regulated to the same general ends—maintenance of a constant body temperature.

Thus the nervous system is not merely a passive victim of hot surroundings, but is actively engaged in combatting their effects. Upon its efforts depends, to a large extent, not only the fate of other bodily tissues, but also its own.

Can Stand Honest Work.

The nervous system has a great deal of work to do in combating heat, but this alone would not worry it unduly. After all, work is its job, and it is built to stand up to a good deal of work. Like the modern motor car, it can stand a lot of honest work; it is abuse which wears it out. Abuse of the nervous system occurs very easily in hot climates. Such abuse may be internal and natural or external and unnatural.

Internal or natural abuse of the nervous system arises largely from circulatory failure as I have mentioned before. Because of the dilation of the skin blood vessels, reduction of muscle tone, and loss of water, the available blood has difficulty in filling the vessels completely. Even a small reduction in the amount of blood available to the brain may have profound effects, so incredibly delicate is its mechanism. Insufficient oxygen may be supplied or insufficient wastes removed.

Even if there is a sufficient volume of blood, it may easily be too concentrated, or have a wrong balance between its acid and alkaline components, or have too little salt, or be at too high a temperature. Any one of these things may throw the working of the nervous system quite out of gear. Mild disturbances might result in tiredness or apathy, moderate upsets in irritability, sleeplessness or neurasthenia, severe disturbances in a complete failure of adjustment to heat with fainting, rapid rise of temperature or death. Milder symptoms are the most common, but by no means negligible. They undoubtedly turn a good many worthy people away from the tropics and furnish a serious and continual drain upon the efficiency of hosts of others, particularly in the field of mental endeavour.

External or unnatural abuses arise from our own ignorance or folly. Unwise eating, both in quantity and quality, neglect of commonsense precautions amounting sometimes to gross carelessness, abuse of alcohol and other stimulants, and failure to face up to facts are appallingly prevalent. I have at times been guilty of most of these, without being in any way conspicuous in my behaviour.

Forewarned is Forearmed.

Internal abuses can be minimised by methods I have already suggested—taking plenty of fluids, eating a balanced diet, adding sufficient salt to the food, keeping a proper balance between rest and exercise, taking all the usual measures to keep physically fit.

External abuses have such obvious remedies that they are very commonly forgotten. It is a true case of familiarity breeding contempt.

Over-eating is general, and eating too much of one type of food at the expense of others is very prevalent. The diet should be as varied as possible, even at the one meal. It is well to choose as much as you can from the "foundation foods"—milk, meat, cheese, eggs, fruit and vegetables, and use other foods only to fill in the gap. In many country places the gaps are as yet many, although improvement is on the way. Much more use can be made of shade in our country towns, and kitchens can be made much less like a vision of the under-world. Larger kitchens placed on the shady side of the house, with insulated or even electric stoves, and adequate coolers, ice chests, or refrigerators are essentials to home-building. Free ventilation in humid climates, thick insulated walls and closed rooms during the heat of the day in dry climates are essential. Air-conditioning is still a dream, but must soon become reality in tropical housing. Something might be done in the matter of adjusting working hours to tropical conditions. As an alternative to the siesta-arrangement, there is the practice adopted widely in Malaya of commencing work about six in the morning and finishing about four in the afternoon, which leaves a considerable and attractive part of the day for social and sporting activities. Alcohol in reason at the end of the day's work is a matter for individual judgment; alcohol during the day in all but the most moderate and dilute form (or in excess at any time) can be nothing but detrimental.

Mental activity requires as much drill as physical. The mental sluggishness characteristic of hot weather is remedied by acclimatization and this in turn is aided by physical fitness. The lapse into mental sloth is insidious but real, unless active steps are taken to forestall it. If efficicncy is to be maintained, this must be done. Mental inactivity as much as over-worry is to be avoided.

SHEEP LAND FOR GRAZING SELECTION.

BARCALDINE AND HOME CREEK RESUMPTIONS.

Portions 7 and 9, parish of Home Creek, comprising part of Barcaldine and Home Creek resumptions, will be open for Grazing Homestead Selection at the Land Office, Barcaldine, on Thursday, 11th November, 1937, at 11 a.m.

The portions are situated about 24 and 28 miles south of Barcaldine.

The areas of the portions are 26,615 acres and 20,930 acres.

The term of each selection will be twenty-eight years, and the annual rental for the first seven years is 4¼d. and 4d. per acre, respectively.

Each selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of three years.

Both portions are artificially watered, but more water will be required on portion 9. They comprise downs country and are first-class sheep areas, suitable for fattening, woolgrowing, and breeding.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agent at Barcaldine, and the Queensland Government Tourist Bureaux at Sydney and Melbourne.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Kangaroo Apple.

K.J.D. (Fernvale)—

The specimen forward with your letter represents the kangaroo apple, *Solanum aviculare,* a native plant that frequently comes up very abundantly following a scrub burn. The plant is not known to possess any medicinal value. The late Dr. T. L. Bancroft found it to contain an alkaloid similar to nicotine. The berries have been sent to us on one or two occasions as a reputed poison to pigs; on another occasion we received specimens of the young growth said to have been responsible for the deaths of a number of sheep in the Tara district. Pulling up by the roots is the only method of eradication. It would probably succumb readily to a weak arsenical spray, but there is always the possibility of stock becoming poisoned by eating the sprayed foliage. We think it likely that after a time the plant will choke itself out. It seems to be essentially a weed of freshly cleared country.

Kangaroo Grass.

B.S. (Bunya, via Aspley)—

The botanical name for kangaroo grass is *Themeda australis.* The heaviest seed crop is borne in the months of February and March, but it varies somewhat with the seasons. Buffalo grass is *Stenotephrum secundatum.* This grass flowers at different times of the year, mostly in the late summer months. It does not produce fertile seeds, at least not under Queensland conditions, and propagation is always by division.

Berries and Burrs.

A.H. (Laidley)—

1. *Melia dubia,* white cedar. The berries of white cedar are poisonous to stock, particularly pigs.
2. *Acanthospernum hispidum,* star burr. A very bad weed in parts of Queensland, particularly in the North. It is not known to be poisonous or harmful.
3. *Cassia Sophera,* sometimes known as arsenic bush or yellow pea. If eaten in any quantity by stock, it probably would cause severe purging, as it belongs to the genus which produces the senna leaves of commerce.
5. *Malvastrum spicatum.* A very common weed of the Mallow family, often called *sida retusa,* but the true *sida retusa* is a different plant. It is not known to possess any poisonous or harmful properties.
6. *Alstonia constricta,* native cinchona or quinine bark. Feeding tests in New South Wales show this plant to produce nervous symptoms somewhat similar to those of strychnine poisoning. It is not likely, however, that an odd mouthful taken by dairy stock or travelling cattle would cause serious trouble.

The rumen contents were examined, but contained only grass and two or three odd leaves of eucalypts, probably picked up in the grass at the time of feeding. No leaves, berries, or seeds of any of the above six plants were found in the rumen contents.

An Edible Berry.

M.H. (Charvel, Theodore)—

The specimen is *Myoporum debile,* a creeping plant producing an edible berry. It is fairly widely distributed in the State, but we have not heard a common name given to it. The generic name, *Myoporum debile,* is quite short enough for general usage. Most of the species of *Myoporum* are shrubs or trees, and the present plant is an exception to the rule, hence the specific name "debile," meaning "weak" or "lowly."

Native Bryony.

S.D. (Coomera)—

Your specimen represents the Native Bryony, *Bryonia laciniosa*, a fairly common vine in parts of Queensland, particularly among the secondary growth in freshly cleared scrub country. It is poisonous, but so far as we have observed, is rarely touched by stock.

Wild Onion.

M.H. (Tannymorel, via Warwick)—

The plant sent is a wild onion or onion weed, *Asphodelus fistulosus*. It is a native of the Mediterranean region. It has appeared in some places on the Darling Downs. In some parts of New South Wales it tends to take possession of the land wherever it gains root. It is not eaten very readily by stock, but if cows happen to eat it an offensive smell is given to the milk.

If you have only a few plants on your property, it would be advisable to eradicate them.

Balloon Cotton.

H.C. (Milmerran)—

The specimen sent is the Cape Cotton or Balloon Cotton, *gymphocarpus fruticosus*, a native of South Africa, now a widespread weed in Queensland. It is usually left untouched by stock, but if eaten in any quantity, is poisonous. The silky cotton surrounding the seeds has no commercial value.

Cudweeds, Turnip Weed, Fish Weed, and Nettles.

G.H. (Booinbah)—

1. This specimen bore neither flower nor seed, but looks like *Gnaphalium* sp., a cudweed. The cudweeds are very common plants, both as weeds of cultivation and of the pastures of Queensland. They are eaten sometimes by stock, but their wiry hairs are said to cause impaction.
2. *Sisymbrium orientale*, tumbling mustard. This and several other plants of the family *Cruciferæ* are known frequently as turnip weeds or mustard weeds. They all give a strong flavour to milk or cream.
3. Specimen too young to determine.
4. *Lamium amplexicaule*, henbit or dead nettle. This is a very common weed during the winter and spring months in many parts of Queensland. It is allied very closely to the stagger weed or wild mint, and, like it, causes shivers or staggers in working horses and travelling stock. Ordinary paddock resting stock, however, eat the plant with impunity. In fact, most dairymen look on it as quite a good fodder.
5. *Rhagodia hastata*. The name fishweed is given to these plants on account of the peculiar flavour they give to milk and cream.

"Mexican Clover"—A Serious Pest.

A.D.C. (Glasshouse Mountains)—

The specimen is *Richardsonia braziliensis*, sometimes called Mexican clover, although this name is rather misleading, as the plant does not belong to the clover family.

It was boomed some years ago as a fodder, but our experience has been, on the whole, that stock do not eat it readily. If you have only a small patch, we would advise you to get rid of it, because once it sets seeds it is a very serious pest, particularly in pineapple plantations.

Purgative Properties.

D.E.E. ("Croxdale," Charleville)—

The specimen is the Bean Bush or *cassia pleurocarpa*. This plant, which is widely spread in Australia, has been very much on the increase in the Charleville district of recent years. It has not been proved definitely poisonous. On the whole, the species of *cassia* contain purgative properties, the senna leaves of commerce being the product of several species.

Mist Weed.

A.H.S. (Yeerongpilly)—

The specimens have been identified as mist weed, *Eupatorium riparium*. This plant has a fairly strong hold in South Coast districts, especially along creeks. In some localities it is thought to be poisonous to stock, but, so far, there is no definite evidence of a poisonous character.

Castor Oil Plant.

A.S. (Roma)—

The specimen you send is the common castor oil plant. The seeds of this plant contain the commonly known castor oil. As the fruit contains a poisonous substance, it should be treated as poisonous. It is presumed generally by botanists that the plant was a native of Africa, but it now is cultivated in many tropical and sub-tropical countries. Its botanical name is *ricinus communis*, and it belongs to the euphorbian family.

Cassia Lignum-Vitae.

C.H. Malmoe Siding, Mundubbera line)—

1. *Cassia eremophila*—the shrub with yellow flowers. Plants of the Cassia genus are mostly regarded as possessing purgative properties. As a rule, stock do not eat them readily.
2. *Vitex Lignum-vitae*, native lignum-vitae. This is not known to be poisonous. It is mostly avoided by stock.

Native Elderberry.

R.C. (Brisbane)—

The specimen forwarded with your letter is the native elderberry, *Sambucus gaudichaudii*, a shrubby plant very common in parts of the Lockyer Valley. We have not heard, however, of its being a bad pest to cultivation. The best means of poisoning it would be to cut it somewhere about ground level and to pour arsenic into the freshly-cut surface as soon as possible. This should run down to the lower parts of the roots and eventually kill them out. So far as we know it is not a pest in any other part of the State.

Spear and Wire Grasses.

M.T.R. (Wallace, via Burketown)—

1. *Heteropogon contartus*, bunch spear grass. The name bunch spear grass refers to the habit of the long awns or spears to become entangled among themselves in bunches. This grass is quite palatable in the young stage. As a matter of fact, we have known it used as a chaff or chop-chop for horses in a drought period even when fairly old. In this state, however, its nutritive value is very low. It is one of the commonest grasses in the coastal and near-coastal belt of much of North Queensland.
2. *Aristida* sp., a wire grass or three-pronged spear grass. The wire grasses, of which there are a number, are very closely allied species. Some are not regarded as having very much value as fodder. The grass you describe as kerosene grass is evidently a species of *spinifex* or *triodis*, of which we have several in North Queensland and the Northern Territory. So far, we have not succeeded in finding a grass that can grow in competition with it and smother it out.

Burr Trefoil.

W.B. (Rocky Creek, Yarraman)—

The specimen is *Medicago denticulata*, the burr trefoil. This plant is very common during the winter and spring months in Queensland, particularly following winter or spring rains. It is quite a good fodder, but, in its green state, is apt to bloat stock if they feed heavily on it. When it dies down it presents a mass of burr-like pods. These are eaten readily by stock, particularly sheep. The plant is particularly common in some of the Downs country, and causes a good deal of trouble in belly-wool. The seed is stocked by most reputable seedsmen, and should be sown preferably in the autumn months.

General Notes

Staff Changes and Appointments.

Mr. H. G. Knust, Instructor in Cane Culture, Innisfail, and Mr. S. A. Clayton, Inspector of Dairies, Caboolture, have been appointed also Inspectors under the Diseases in Plants Acts.

Constable J. H. Lewis, Emerald, has been appointed also an Inspector under the Brands Acts.

Messrs. A. R. Brooks and E. A. Harden, of Zillmere Road, Zillmere, have been appointed Honorary Rangers under the Animals and Birds Acts.

Messrs. M. Buchanan (Gympie) and E. N. Greaves (Coolangatta) have been appointed Growers' Representatives on the Banana Industry Protection Board until 30th September, 1938.

Messrs. D. F. Vaughan (District Scout Commissioner, Rockhampton), L. V. Masters (Organising Commissioner, Boy Scouts' Association, Brisbane), W. R. Thomson (Scoutmaster, Rockhampton), S. W. Holmes (Cubmaster, Taringa), and A. J. O'Farrell (Scoutmaster, Koumala) have been appointed honorary rangers under the Animals and Birds Acts.

Mr. C. J. McKeon, Director of Tropical Agriculture, has been appointed Director of Agriculture, Department of Agriculture and Stock.

Mr. W. Leslie, Assistant Instructor in Fruit Culture, has been transferred from Toowoomba to Bowen.

The resignation of Mr. B. Courtice, Bundaberg, as a representative of sugar-cane growers on the Sugar Experiment Stations Advisory Board, has been accepted.

The following have been appointed honorary rangers under "*The Animals and Birds Acts*, 1921 *to* 1924":—

Messrs. S. W. Gibson, H. V. Hanson, W. F. Klaka, J. Roberts, G. Mann, E. W. Ford, F. Ferguson, E. G. Fowler, J. Harris, A. P. Couper, T. R. Lucas, H. J. M. Ransden, D. Watt, senr., H. Watson, and C. J. Mann, of the Inkerman Mill Suppliers' Committee, Home Hill; and

Messrs. W. M. E. P. Prufert and T. Knopke (Summerhill), S. W. Hutchens, junr. (Crediton, Dalrymple Heights), J. V. Sullivan (Dalrymple Heights), and R. J. C. Wood (Eungella, Dalrymple Heights).

Cotton Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts providing that the growers' representatives on the Cotton Board shall be elected triennially instead of biennially as at present. The members of the board shall hold office for a period of three years, and this provision shall apply to the 1937 election of members, as well as to all future elections.

Grade Standards for Cavendish Bananas.

Schedule 6 of the Fruit and Vegetable Grading and Packing Regulations has been rescinded and a new schedule, embodying grade standards for Cavendish bananas, issued in lieu. The amended grades provide for cased bananas packed in both clusters and singly. Cased bananas packed in clusters shall be divided into three grades—"Small," "Standard," and "Large"—and at least 90 per cent. of the bananas in any case so packed shall consist of clusters of not less than three bananas each. Cased bananas packed in singles shall be divided into five grades—"Small," "Sixes," "Sevens," "Eights," and "Nines."

Broom Millet Board.

Orders in Council have been issued under the Primary Producers' Organisation and Marketing Acts providing that elections of growers' representatives on the Broom Millet Board shall be held triennially and that members elected shall hold office for three years; further, giving notice of intention to extend the operations of the Board for the period from 1st November, 1937, to 31st October, 1943. Growers of broom millet who have supplied their product to the Board may forward a petition for a poll on the question of whether or not the Board shall be extended as above.

"Pig Breeders' Annual"—World Pig Progress.

Published by the National Pig Breeders' Association of Great Britain as one of a series, the 1937-38 edition of the "Pig Breeders' Annual" just to hand from London is a worthy successor to a long line of useful, informative publications, which have gained for the "Annual" a world-wide circulation, and this latest edition has been the means of distributing an immense amount of helpful information to pig raisers in all parts of the world.

The "Pig Breeders' Annual" is the only publication of its kind in the world. Its contributors are men well and favourably known in the sphere in which they work, and as units in a world-wide organisation; and its appeal is one that should find for it a place in the library of every pig producer whose heart is in his business.

Among the many very informative contributions to the book is that which deals with the world's pig progress, a survey of production in all the principal pig-raising countries, with informative statistics, and a general review of the lines along which different peoples work in this particular industry.

The Australian contributors include Mr. E. J. Shelton, H.D.A., Senior Instructor in Pig Raising in the Queensland Department of Agriculture and Stock, who deals in an interesting way with the influence of N.P.B.A. breeds on Australia's pig-breeding industry, and Mr. Richard G. Watson, of Brisbane, who gives his "Impressions of European Pig Production," gathered during a recent visit to Great Britain and Denmark.

Mr. Watson, in addition to being a successful commercial and stud pig farmer, is also vice-president of the Queensland branch of the Australian Stud Pig Breeders' Society and chairman of the Australian Pig Industry Council, as well as being the pig producers' representative for Australia on the Australian Meat Board.

In addition to many other helpful contributions, the outcome of experiments, research, and surveys, the "Annual" carries a large number of useful tables, statistical data, clear sharp illustrations, and many very fine advertisements.

The fact that 500 copies of this publication already find a place in the homes of Australian pig producers should be a guarantee of good faith and an assurance that at 3s. 6d. post free it represents excellent value. Copies may be obtained direct on receipt of remittance addressed to Mr. E. J. Shelton, Department of Agriculture and Stock, Brisbane, Queensland.

Control of Plague Grasshoppers.

A Proclamation and Regulation have been issued under the Diseases in Plants Acts declaring that the area comprising the pastoral districts of Moreton and Darling Downs shall be a quarantine area in respect of the plague grasshopper, and prescribing the nature of the quarantine to be imposed.

Provision is made for the laying of baits prepared from arsenic pentoxide, molasses, water, and bran on roads, stock routes, and reserves where the grasshoppers are prevalent. Property owners and local authorities shall lay such baits on their holdings and all areas under their supervision.

The following officers of the Department of Agriculture and Stock have been invested with the powers of Inspectors under the Diseases in Plants Acts, and will be available to render any assistance in connection with the control of the pest:—

Messrs. P. Round (Pittsworth), R. E. Watson (Oakey), E. T. Lewin (Dalby), D. Culhane (Toogoolawah), and A. Hossack (Laidley).

Queensland Cane Growers' Council.

The result of the voting in connection with the levy of ½d. per ton of sugar-cane harvested during the present season—to be utilised by the Queensland Cane Growers' Council by expending the same on matters of an economic, legal, or compensatory nature where such matters are of vital importance to the sugar industry—was:—

For the levy	911 votes.
Against the levy	2079 „

Fruit Fly in the Stanthorpe-Warwick-Killarney District.

A Proclamation and Regulation have been issued under the Diseases in Plants Acts declaring the Stanthorpe, Warwick, and Killarney districts to be a quarantine area in respect of fruit fly, and prescribing the nature of the quarantine to be imposed in such area. Orchardists shall control fruit fly by placing, at certain specified periods, traps charged with fruit fly lure approved by an inspector at the rate of ten per acre amongst all trees in their orchards.

Rural Topics

Lamb-marking.

The term "lamb-marking" covers the castration and tailing of the male lambs, tailing the ewe lambs, and the snipping of the registered ear mark. The best age at which to mark is from a fortnight to one month old.

The operation should be performed under the most hygienic conditions possible. The use of old yards should be avoided so as to minimise the risk of tetanus and septicæmia. All instruments should be absolutely clean at the commencement of operations and must be dipped into a disinfectant frequently during the progress of the work.

There are two methods of castration, namely, tipping and slitting. The latter practice has the advantage of giving a wether a better cod when fat.

Tipping, however, is advocated, for the wounds heal more quickly in lambs treated in this way. Where the flock is small, farmers are advised to hurdle off a temporary yard in the corner of a paddock. The lambs, when marked, should be dropped on to clean pasture land. A non-arsenical dressing, which is both curative and blowfly repellant, should be applied to all wounds with a clean swab or brush, and a careful watch kept over all treated lambs. Should the flies be bad fresh treatment may be necessary.

—*J. L. Hodge.*

Milk from Newly-calved Cows.

With the approach of spring, dairy farmers should be careful regarding their increased milk supplies, especially colostrum milk. The milk of the newly-calved cow is abnormal, and is called colostrum or beastings. It is yellow in colour, has a rather strong pungent taste, an unpleasant odour, a sickly albuminous flavour, a high specific gravity, a high total of solids, high albumen, and low figures for fat and sugar. The fat of colostrum has different properties from that of normal milk, and the sugar is largely glucose and not lactose—it also shows a larger proportion of phosphate.

Such milk serves as food for the new-born calf, and increases the resistance of the calf to disease during the first few days of its existence. It is not to be used as a means for increasing the supply to the factory. The milk becomes more normal day by day until, in seven days after calving, it is practically normal, although it may take up to a fortnight to attain perfectly normal composition.

It is advisable to isolate the newly-calved cows, and for the first seven days at least this colostrum milk should not be mixed with normal milk, either for butter or cheese making. Cream from such milk blended with good cream results in the whole delivery being graded down either to second grade, or in being completely rejected. For that reason this milk should not be separated on any account. Colostrum milk is quite unfit for cheese-making, since it is easily coagulated by heat, curdles very slowly with acids and rennet, and results in very poor quality cheese.

It should be remembered, therefore, that:—(1) Colostrum milk is food for young calves only; (2) it should on no account be sent to cheese factories or, as cream, to butter factories.

—*O. St. J. Kent.*

Tar Branding of Sheep.

Wool from sheep which have been tar-branded is sold often at a lower price than wool branded with one of the several branding fluids on the market. These branding fluids are very satisfactory, being harmless and having no ill-effects on the wool, while at the same time they are readily emulsifiable.

It is difficult to remove tar from the wool during the process of manufacture. Tar-stained wool, therefore, may bring a lower price than clean wool free from tar.

The grazier obviously in his own interests should discontinue the practice of tar-branding.

Jack Howe, Shearer—The Man and His Records.

Jack Howe, in his own day and in his own sphere, was just as well known as any champion cricketer or boxer, and, as is the case with all champions, there was no lack of rivals eager to displace him from his position of pre-eminence. Shearers would make big journeys to try their skill against him, but nearly all of such contests enhanced rather than diminished Howe's reputation.

On one occasion Howe was shearing at Evora Station. Amongst the other men was a very fast shearer, Harlin by name, who came from New Zealand. Harlin had hopes of "ringing" the shed in spite of Howe, and there was keen interest amongst the rest of the men to see how the two champions would fare. Shearing started on a Monday. On that day the Queenslander shore 111 sheep and the New Zealander 92—not high tallies for first-class shearers, but the sheep carried a great deal of sand in their fleeces. On the Tuesday Howe's tally was the same, with Harlin's a little closer to it; it was successively closer still on Wednesday, Thursday, and Friday, and it appeared that Howe at last was to meet his match. There was a belief held by some of the men that the champion was apt to "go to pieces" when pressed, and, acting on this belief, Harlin's backers urged their man to make a special effort on the Saturday, when only a half-day would be worked. The New Zealander responded to their urging with a very good tally of 84 for the half-day. But, to the surprise of everyone and to the discomfiture of Harlin, Howe's tally still remained at 111. The victory was such a decisive one that it ended any hopes of Harlin "ringing" the shed.

Howe established his famous record when shearing at Alice Downs in 1892. Between the starting and "knock-off" bells on October 10 of that year he shore no less than 321 sheep, and in so doing established a shearing record which has never been bettered. Keeping in mind that the shearing sheds of that period worked longer hours than they do to-day, Howe averaged more than a sheep every two minutes throughout the whole day. Even this fact, remarkable as it is, does not show what Howe was capable of when really extended, for, as a final spurt, during the last five minutes of his record-making day he shore five sheep, and had the sixth on the board as the bell rang, which, in accordance with shearing shed practice, was included in the day's tally.

Few records of any sort are established under anything but favourable circumstances, and Howe's feat was no exception to this rule. The sheep that were hurried up the race and bustled into the pens of Alice Downs shed on that memorable day were practically free of wrinkles, and carried open fleeces of a little less than the full 12 months' growth. Nevertheless, in every way it was a genuine record, and Howe received no assistance from anyone to which he was not fairly entitled, although it is safe to assume that his pen mate handled any rough sheep that were sent in to their catching pen. Favourable as the circumstances were to speedy shearing, the next fastest man on the board—a New South Wales champion—could not get to within a hundred of Howe's tally, so that his superiority was definitely emphasised in more ways than one. In this machine age, it is of interest to note that the record was made with blades.

Howe was not only a fast shearer—he was a good one as well. His work was marked by that effortless ease which is the mark of the master, and neither the man that owned the sheep, nor the boy that picked up the fleeces, nor the shed hands that rolled them, ever had reason to complain of his work. He died a few years ago in the centre of that district where he had created so many records, and his end was in keeping with a man who had always been a good sportsman and a true friend. He is one of the select few whose name is perpetuated by an article of clothing, for even to-day in the shearing sheds of Queensland the men speak of a sleeveless shirt as a "Jacky Howe"—the older ones with a reminiscent gleam occasionally lighting their eyes as the name recalls to their mind the big shearer who had set such a rattling pace forty years before.—B.W.P. in the "Sydney Morning Herald."

A Show Impression.

One of the advantages of owning livestock is the thrill to be got out of a good stock show. Shows are an excellent training ground for young farmers of ambition and arouses in them a sense of responsibility, and, above all, they learn how to take defeats as well as successes. Everyone likes the man who when he misses the blue ribbon says that his exhibit was beaten by a better beast. Behind every exhibit at the show there is keenness, intelligence of a high order, considerable capital, and a real love of the land and its industries.

New Legislation for Poultry Industry.

To give further protection to poultry farmers, amending legislation has been passed by the State Parliament. A method of determining the sex of "day-old" chickens—a method that requires the highest proficiency—is a recent discovery. The object of the new legislation is to make sure that only properly-qualified and expert persons may be licensed for the work of sex determination in chickens. When chickens are classified as cockerels it is usual for poultry farmers to sell them for rearing as table birds. The new measure will prevent unscrupulous dealers from selling the male chickens as a mixed flock or—as has happened—as pullets. Persons licensed to sex "day-old" chickens will be required to mark with a stain all chickens that they decide are males.

The Act provides also for the voluntary registration of hatcheries, with the object of raising standards in the chicken-dealing business.

Under the original legislation all poultry diseases had to be notified, but the amending measure makes it no longer necessary, except in cases of highly contagious diseases.

The selling of or attempting to sell diseased poultry for table use—poultry unfit for human consumption—is an offence, and inspectors will have much wider powers of condemnation.

The amending legislation will be welcomed by poultry farmers as a measure designed to further protect their interests, when either buying or selling.

Dehorning Calves.

Every dairy farmer knows the advantages of dehorning his poddies. There are sound reasons for dehorning cattle while they are still young. The operation is less painful than it is with grown cattle. It is cheap, quick, simple, and effective if reasonable care is taken. A herd of dehorned cows are quieter to handle and more content when yarded. They are not so liable to injury. They will give better and more consistent production.

Until the calf is about a week old the horn buttons are either not attached or loosely so, to the bones of the skull. It goes without saying that it is in this period that dehorning with caustic potash will give 99 per cent. results.

The best way to do it is to tether the calf short, but with rope enough to allow it to pull back. It can be straddled easily then. With sharp scissors clip the hair from each horn button. Roll a stick of caustic potash in a piece of paper, with one end protruding. In this way it may be handled without injury to the fingers. Dip the end of the caustic in water, and shake off surplus water, for if it drips the water may run into the eyes of the calf and blind it.

Each horn button should then be rubbed thoroughly with the point of the caustic until the skin is well broken. In a few hours the caustic will have done the job quite well.

No further treatment is required, but the calf should be kept covered for twenty-four hours. Bull calves usually require more treatment than heifers.

Caustic potash will last for years in an air-tight tin or jar, but—*and this is important*—do not keep it where children can get it.

Trucking Fat Lambs.

Complaints of the bruising of lambs consigned to market are not uncommon, but to a great extent the remedy lies in the hands of growers.

The tenderness of sucker lambs is often not appreciated sufficiently, and in many cases they are handled like fat sheep. Sheep, too, may be bruised by bad handling, though not so badly as sucker lambs. It should be remembered that true sucker lambs have never been off the mothers. It is advised, therefore, that if a road journey has to be undertaken some of the ewes should accompany the lambs to the trucking yards. A lamb should never be lifted by the skin. Prodding sticks should never be used. Over-crowding in the trucks should be avoided entirely. In all cases, every endeavour should be made to deliver the lambs at the market with the bloom on them. A certain loss in weight and appearance is unavoidable on a long journey, but if the foregoing rules were observed strictly, complaints of bruising would be rare.

Orchard Notes

NOVEMBER.

THE COASTAL DISTRICTS.

Citrus Fruits.

In the citrus orchard the increase in temperature and the possibility of a dry period call for the utmost attention to soil conditions, particularly aeration and moisture conservation. At the slightest sign of distress, owing to lack of moisture, trees should be irrigated thoroughly whenever water is available for this purpose.

At the same time care and attention should be given to cultivation, particularly on hillside orchards, and in the coastal districts the possibility of the approach of storms will prompt growers to consider the completing of each cultivation by forming shallow drains to care for excess water and prevent soil losses.

Attention must be given to the incidence of mites, which are the direct cause of the darkening of the skin of the fruit known as "Maori." Usually the first indication of the trouble is when, with the sun shining on it, the fruit has the appearance of being covered with a grey dust. If examined with a good lens, the skin will be seen to be covered with numerous yellow slug-like insects which are living on the skin.

Under certain weather conditions scale movement may be expected.

Detailed information regarding insect control may be obtained from Department publications on the subject.

Pineapples.

Continue planting pineapples as discussed in these notes last month, always remembering that the modern practice is smaller areas, close planting with more pineapples per acre, quicker, better and more healthy growth, and finally better fruit by liberal fertilising through the leaf bases with 10-6-10. Taken all together, these recommendations tend towards the elimination of wilt.

Bananas.

New Plantings.—November and December are very suitable planting months in most districts. Just as modern methods have effected great improvements in pineapple culture, so they might be applied in principle to banana growing. Smaller areas and large production per acre should cut overhead costs and lighten labour, lengthen the profitable life of the plantation, and reduce the time of waiting for the crop. To this end select planting material with care, plant in large holes, and break up the ground as soon as possible after planting. To prevent the loss of top soil by erosion and to provide the bananas with a cooler and moister environment, plant a cover crop as soon as weather permits, and initial weed growth has been suppressed. This will hold the loose surface soil during the summer rains.

Young Plantations.—The correct follower or followers for each plant should be selected, if not already done, and all additional suckers suppressed. Cultivate to conserve moisture and mulch with a cover crop. A complete fertilizer will improve the coming crop.

Old Plantations.—De-sucker to one follower to each plant. Apply a complete fertilizer, if not already done, and cultivate to conserve moisture.

General.—Bait for borers; be prepared for grasshopper and caterpiller plagues; watch for bunchy top.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

KEEP the orchards and vineyards in a thorough state of cultivation, so as to keep down all weed growth and conserve moisture in the soil. This is important, as if a long spell of dry weather sets in, the crop of summer fruit will suffer severely from the lack of moisture. Citrus trees should be irrigated where necessary, and the land kept in a state of perfect tilth. Spraying for codlin moth should be continued, and all pip fruit trees must be bandaged at the beginning of the month; further, the bandages must be examined at frequent intervals and all larvæ contained in them destroyed. The neglect to spray thoroughly and to attend to the bandages properly is responsible for the increase in this serious pest in the Granite Belt, and growers are warned that they must pay more attention to the destruction of this

pest if they wish to grow pip fruit profitably. Fruit fly may make its appearance in the cherry crop; if so, every effort should be made to stamp out the infestation at once, as, unless this is done, and if the fly is allowed to breed unchecked the later ripening crops of plums, peaches, apples, pears, apricots, and Japanese plums are bound to become more or less badly infested. Combined action must be taken to combat this the most serious pest of the Granite Belt, and growers must realise that, unless they take this action and see that careless growers do not breed the fly wholesale, they will never keep it in check, and it will always be a very heavy tax on their industry. Rutherglen bug is another serious pest in this district, and is propagated by the million by careless orchardists. The best remedy for this pest is to keep the orchard clean and free from weeds. A sharp lookout must be kept for brown rot in fruit, and, on its first appearance in a district, all ripening fruit should be sprayed with the sodium sulphide wash.

All kinds of leaf-eating insects should be kept in check by spraying with arsenate of lead, and all grape vines, potatoes, and tomatoes should be sprayed frequently with Bordeaux or Burgundy mixture, the former for black spot and downy mildew, and the latter for early and late (Irish) blight.

TOURIST TRAVEL.

Vivid impressions regarding the possibilities of tourist travel in Queensland are gained during visits to different parts of the State. The tourist industry, as it may be termed, has become, like talking pictures, a world-wide industry and is being highly organised and widely advertised by the countries which have attractions to offer. Competition is very keen. Tourists might be divided broadly into three groups—intrastate, interstate, and overseas; each group has its special desires and idiosyncrasies, and thus the calls upon a tourist agency are many and varied. If the attractions are not made sufficiently enticing the tourists, particularly those belonging to the interstate and overseas groups, will go elsewhere. The Railways Department has done very good work in extending the activities of the Queensland Tourist Bureau, but progress seems to have reached a stage at which the Department needs the co-operation of outside bodies. Besides the actual attractions, there are such factors as access roads (in addition to main roads) and general approaches, modern hotel or other accommodation, water supply, lighting, and sanitation—which have a marked influence on tourists. But these things are controlled by a variety of authorities; these authorities might embrace—Main Roads Commission, Forestry Department, Licensing Commission, Local Authorities, Electric Light Authorities. Even the advertising and displaying to better advantage for tourist purposes of many of the unique attractions may fall to non-governmental authorities, and some of these bodies may not be able to take appropriate or adequate action through lack of ways and means. It was therefore suggested to the Premier (as President of the Bureau of Industry) that the Bureau, whose function it is to do work of the kind, should be deputed, in co-operation with the Railways Department, to inquire into the aspects outlined and to furnish a composite scheme for the further and wider orderly development of tourist travel in Queensland: the scope of the inquiry to include the exploration of all relevant possibilities; the making of contact with individuals, groups, and organisations interested in the subject; the devising of ways for the securing of co-ordination amongst authorities which control utilities essential to a successful scheme of tourist travel; and, generally, to formulate an attractive and progressive programme which may be put into operation, piece by piece, as opportunity offers. The suggestion found favour, and the Bureau and the Commissioner for Railways have the matter in hand.

—From the Annual Report of Mr. J. D. Story, I.S.O., Public Service Commissioner.

Farm Notes

NOVEMBER.

Field.—Farmers are commencing to realise that quick-maturing wheats which possess a degree of rust resistance are more dependable than the slow-growing and often rust-susceptible kinds, which are gradually giving place to these and mid-season varieties.

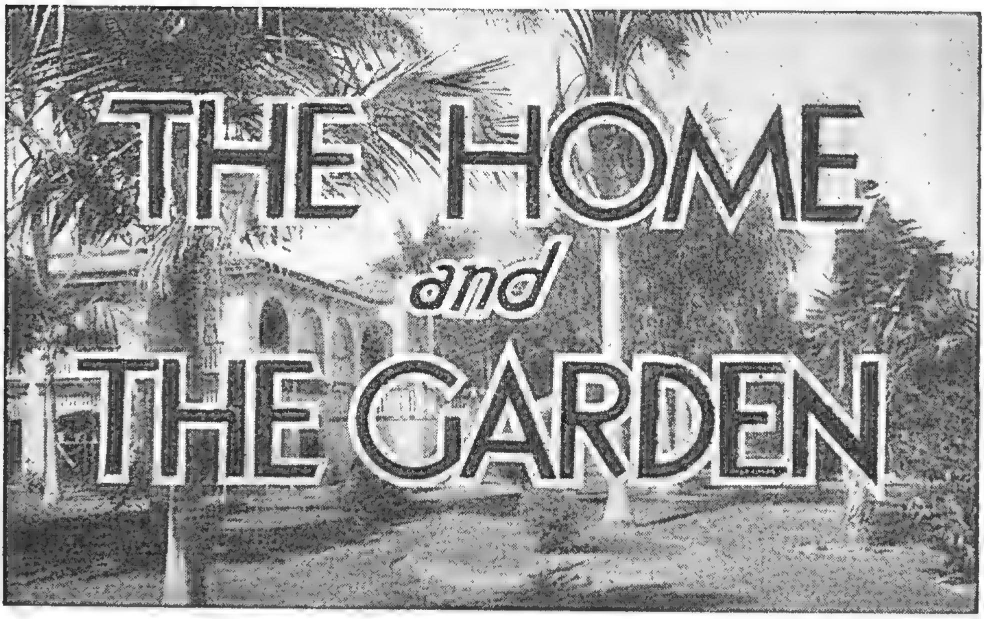
Growers are advised to make every preparation to work up the surface of the ground immediately after the removal of their crops, so that the soil may be put into good condition to receive any rain which falls, the conservation of which is the best guarantee for the success of the next succeeding crop. Such initial preparation also encourages the early growth of all foreign and weed seeds and permits of their eradication by the implements used to produce the desired soil mulch. In such manner paddocks are kept clean and the purity of crops is maintained. The careful preparation of areas intended for maize-planting cannot be impressed too strongly upon growers. Deep and thorough ploughing, followed by cross-ploughing and subsequent cultivation of the soil, must precede sowing if success would be attained; and all efforts must be concentrated on obtaining a good surface mulch. Failure to follow up the subsequent sowings by harrowing prior to the appearance of the young plant conduces to weed growth and very often entails subsequent hand-hoeing between the plants in the drills. Harrowing should be discontinued before the plant breaks through the surface, otherwise damage will accrue to the tender shoots of the young plants. When the young maize plant has hardened up it may, with advantage, be lightly harrowed in the direction of the drills, but such practice must discontinue once the plant has attained a height of 6 inches. Close cultivation by inter-row cultivation implements is necessary after every shower to conserve moisture and to prevent weed growth, care being taken to ensure each cultivation being shallower than the preceding one, and so prevent damage to the root system of the plant, which is extensive. Inter-row cultivation should cease with the advent of the cob on the plant; and, if proper attention has been given to the crop, it should, at this period, be unnecessary. Where crops are planted on the check-row principle, inter-row cultivation is facilitated, and more even crops result.

The French millets (red and white), owing to their rapid maturing qualities, form excellent intermediate or supplementary crops, and are suitable for present sowing. Their value for fodder and seed purposes is worthy of more general recognition at the hands of the average farmer.

Past dry periods have impressed upon us the necessity of providing during good seasons against the return of less favourable ones, and in this connection the cultivation of quick-growing fodder plants appeals to us. Many varieties of useful classes of fodder can be cultivated over a large portion of this State; chief of which, perhaps, are the sorghum family for grain and fodder purposes. Of the latter, Sudan grass has much to commend it, and is fast becoming one of the most favoured by stockowners. Grain sorghums, of which Feterita, Red Kafir, and the various Milos are examples, should occupy a more prominent position for purposes of horse and pig feeding, and are suited particularly to those localities which are unsuitable for maize production. Some varieties of sorghums have strong frost-resisting qualities, and lend themselves to those localities where provision for some form of succulent fodder is necessary during the winter months.

COOLING OF CREAM.

If properly used under conditions of scrupulous cleanliness, a cream cooler will give excellent results. Besides lowering the temperature of the cream and thus checking bacterial development, a cooler ærates the cream, releases gases and food flavours, and improves its consistency. Freshly separated cream, after it has been cooled sufficiently, should be mixed with the cream already held in the dairy. Fresh and over-ripe cream should not be mixed, as is often done when lots are held in separate vessels until delivery day. Cream should be stirred frequently while it is held on the farm. Proper stirring controls the ripening.



OUR BABIES.

Under this heading a series of short articles, by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

CHILD WELFARE.

MOST important are the early beginnings of all things. Especially is this true of health. On the health of the mother depends the health of the infant; on the health of the infant depends the health of the child; on the health of the child depends the health of the adult; on the health of the adult depends the health of the State; and these must not be left to chance.

Largely they have been left to chance. Of recent years something has been done to promote health, something apart from the attempt to cure disease by hospitals and other means. Let us clearly understand that disease is nothing in itself, but only the absence of health, and that it is by the cultivation of health that we can best diminish disease. If our people are to be healthy they must learn to think in terms of health, and not in terms of disease. They must pursue the living fact, and not waste their energies in struggling with shadows.

There are three things that are now of the greatest importance. Firstly, the care of the expectant mother. This care is the responsibility of her medical adviser. The Lady Bowen Hospital has an ante-natal clinic; so have other maternity hospitals; and there are ante-natal clinics in the Valley and Woolloongabba. We must so educate our mothers that the excellent work done by all these shall be multiplied tenfold. For want of knowledge mothers and infants die or are crippled in health. Most pathetic is the loss of life and the survival of weaklings owing to the want of this care, which is freely offered to all mothers who will seek it.

Secondly, we want to reach, as far as possible, every mother and infant in the State. In the last fifteen years our infant mortality has fallen considerably, and we hope that it may fall still lower.

Thirdy, the health of the young child is now a pressing problem. Ill-health and deaths from infection are far too common. We must spread knowledge of the ways to prevent the spread of infection and to increase the resistance to infection by a sound diet rich in vitamines. Something has been done in this direction, but much more remains to be done. By special means we can give immunity to diphtheria and typhoid fever, and can surely eradicate hookworm; but against other infections very little has been done.

Let us do these things that we can, and presently we shall be able to do things that are now impossible.

IN THE FARM KITCHEN.

Inexpensive Meat Dishes.

To make cheap cuts very palatable, steep in seasoned oil and vinegar, allowing 2 tablespoonfuls olive oil to 3 tablespoonfuls of vinegar. Add to this 1 tablespoonful each of onion and chopped parsley, and pepper to taste. Soak meat for 1 hour, at least, turning in liquid occasionally.

Boiled Breast of Mutton.

Take 2 carrots, 2 small turnips, breast of mutton, boiling water, salt to taste.

Wipe the meat. Place in a saucepan. Cover with boiling water. Add salt to taste. Cover and boil fast for ten minutes, then simmer gently for one and a-half hours. Add sliced scraped carrots and peel turnips, cut into suitable pieces, cover, and simmer for half an hour.

Oxford Hot Pot.

Take 1lb scraps lamb or mutton, 2 sheep's kidneys, 1½ lb. small potatoes, 2 onions, 3 gills water, salt, and pepper to taste.

Place the meat, onions, and halved and scored kidneys in a casserole. Add water, potatoes, and salt and pepper to taste. Cover and cook in a slow oven till the potatoes are tender, but not broken. Remove the lid from the casserols for the last quarter of an hour to brown the hot-pot. Serve in the casserole.

Roast Breast of Mutton.

Take 3 lb. breast of mutton, 6 oz. breadcrumbs, 1 onion (minced), salt and pepper, ½ teaspoonful chopped thyme, 2 tablespoonfuls chopped parsley.

Remove the bones from the meat, also any brown skin on the outside. Stew the bones in one and a-half pints of water and use for gravy. Flatten the meat well with a rolling-pin. Scrape all trimmings of meat and fat from the bones and put through the mincer twice. Soak the breadcrumbs in water until soft. Squeeze till almost dry. Put bread, minced meat, parsley, thyme, onion, and seasoning into a basin, and mix well. Spread stuffing on to the boned meat on the side from which bones have been removed. Roll up loosely and tie. Roast in a quick oven, basting with the fat that drips from the joint. Do not add any dripping to the pan. Dish up the roast. Remove string. Pour off most of the dripping from the pan, leaving only about a tablespoonful. Add half an ounce of flour. Stir into the fat and fry slowly till brown. Add half a pint of stock from the bones. Boil for four or five minutes. Season to taste, and serve in a sauce-boat.

Scotch Meat Shape.

Take ½ lb. minced meat, 2 oz. minced suet, 3 oz. breadcrumbs, ¼ teaspoonful curry-powder, 1 beaten egg, pinch of herbs, stock, pinch of nutmeg, brown breadcrumbs to cover.

Mix all the dry ingredients together, and add the well-beaten egg and a little stock. Pour into a well-greased mould. Cover thickly with brown breadcrumbs. Cover with a buttered paper. Steam for one and a-half hours. Serve turned out with gravy or white sauce.

Stewed Lamb and Green Peas.

Take 1½ lb. middle neck of lamb, 1 onion, 1 oz. dripping, 1 oz. flour, 1 pint water or stock, 1 tin green peas, salt and pepper to taste.

Melt the fat in a saucepan. When smoking hot, add the peeled and chopped onion and fry till brown and crisp. Remove the onion. Add the meat divided into suitable pieces for serving. Brown on both sides. Remove to a dish and drain off any remaining fat in the pan. Mix the flour to a paste with a little of the water or stock. Turn into a saucepan. Stir in the remainder of the liquor. Keep stirring till boiling. Add the meat and onion and simmer gently for two and a-half hours. Add drained tinned peas and bring again to the boil. If you use fresh peas, add them about thirty minutes before the stew is ready.

Steak and Kidney Pie.

Take 1 lb. shoulder steak, 2 kidneys, ½ lb. flaky pastry, 1 tablespoonful flour, 1 minced onion, salt, pepper, 1 egg.

Cut the steak into very thin slices; split, skin, core, and slice the kidneys. Mix flour, onion, and seasonings. Dip the meat in flour. Pack loosely into a pie-dish a little above the level. Cover with pastry. Decorate edges with the back of the prongs of a fork. Cut a hole in the centre. Brush top with beaten egg.. Bake in a quick oven to start with to firm the pastry, then reduce the heat and finish cooking.

Stewed Shin of Beef

Take 2 lb. shin beef, 1 carrot, 1 clove, 1 bayleaf, 1 tablespoonful flour, ½ teaspoonful pepper, 1 medium onion, 1½ teaspoonfuls dripping, sprig parsley, 2 teaspoonfuls salt, 1 quart boiling water.

Have the bone cut into one or two pieces. Place the shin with the peeled, sliced onion, carrot, clove, bay-leaf, parsley, salt and pepper in a stewpan. Add water. Cover and bring to the boil. Simmer for four hours. Melt the dripping in a saucepan. Stir in the flour, then gradually stir in half a pint of the water in which the meat was boiled. Stir till boiling. Boil two minutes. Add meat and marrow from the bone. Serve with boiled or mashed potatoes. Use the remainder of the liquid as the basis of a vegetable broth.

Beef Olives.

Take 1 lb. stewing steak, 2 teaspoonfuls flour, 1 tablespoonful diced turnip, 1 tablespoonful diced carrot, salt, pepper, 1 tablespoonful dripping, 1½ oz. chopped ham, 1 heaped tablespoonful parsley, 5 heaped tablespoonfuls breadcrumbs, salt, pepper, herbs, stock.

Mix the crumbs with the chopped ham, parsley, salt, pepper, and herbs to taste. Add enough extra stock to moisten well. Divide the steak, cut into a thin slice, into four or five portions. Spread with the ham mixture. Roll up each portion and tie firmly with string. Dip in seasoned flour. Brown in smoking hot dripping in a frying pan. Place in a casserole. Brown the vegetables and add to the casserole with the stock. Cover and simmer for three and a-half hours. Serve with mashed potatoes.

Hamburg Rolls.

Take 3 cupfuls minced beef, 1 cupful rice, cabbage leaves, tomato sauce, salt, pepper.

Mix the meat with the rice, which has been boiled in plenty of salted water, till tender. Cook the cabbage leaves in boiling salted water for two minutes, then drain well. In the middle of each leaf put two tablespoonfuls of the mixture, seasoned to taste, and fold the leaf over. Place in a buttered fireproof dish. Cover with tomato sauce. Bake for one hour and serve.

Pot Roast of Beef with Cabbage.

Take 3 lb. brisket, 1 cabbage, 2 tablespoonfuls dripping, 1 small onion, 2 tablespoonfuls vinegar, 2 tablespoonfuls sugar, salt and pepper.

Melt the dripping in a saucepan. Shred the cabbage. Peel and mince the onion. Cook the vegetables in dripping until brown. Season to taste with salt and pepper. Place the meat in another saucepan. Cover with cold water. Cover and bring to the boil. Add cabbage and onion. Simmer till both are tender. Add vinegar and sugar, and, if not thick enough for your taste, thicken the gravy with a little cornflour dissolved in water. Bring to the boil and cook till smooth.

IN THE FARM GARDEN.

THE GARDEN COMPOST HEAP.

THE garden compost heap is a cheap means of converting garden and household vegetable refuse into valuable fertilizing material. Materials such as lawn clippings, spent crops free of disease, vegetable tops, &c., should all be used in this manner, but the coarse, woody stalks of strong-growing plants should not be used.

The production of artificial manure from garden waste, straw, &c., consists in the decomposition, by fungi and bacteria, of much of the plant material. The nitrogen in the process is converted from an inorganic to an organic form, and is present in increased amount in the material finally produced. The rapidity with which the process goes on is influenced by the type of material, its degree of maturity and chemical composition, and by the presence of nutrients such as lime, phosphate, nitrogen, and potash, for the organisms carrying on the decomposition are much akin to plants in their requirements.

Actual damage can be done to crops, other than some legumes, by the addition of uncomposted, poor-quality material to the soil. This damage is due largely to a lack of available nitrogen in the soil. Such poor-quality materials as bush scrapings, dry mature grass or straw, offer a good source of energy for the soil bacteria and fungi, which rapidly increase in numbers, and in so doing consume all the available nitrogen. This competition for soil nitrates results in the nitrogen starvation of crop plants.

The usual process of allowing plant refuse to decay without any chemical treatment results in a very acid product, providing no immediately available nitrogen. With nitrogen-poor plant residues it becomes necessary to add available nitrogen to the heap, as well as lime, which prevents the development of acidity, and phosphate, which is required in the nutrition of the organisms. With nitrogen and mineral-rich materials such as legumes (peas, beans, &c.), green vegetable tops, and other green succulent material, the use of lime alone should be sufficient to enable rapid decomposition.

With general refuse or poor-quality material, a heap can be made on a square base, and of such size that the final height is about 3 feet. Spread the chopped-up material in layers several inches deep, treating each layer in the following manner:—

Snow over with ground limestone (5 lb. per 100 lb. material), fork in loosely, give a sprinkling of superphosphate, and then add sulphate of ammonia at the rate of 1½ lb. per 100 lb. material. The material should be moistened before building up the layers, if not already moist. Ammonia may be given off slowly, so that it is necessary to keep building up and treating the successive layers quickly, so that it will not be lost. The final layer is not treated, and may be given a covering of an inch of soil. When next the heap is added to, the untreated layer can be moistened and treated.

When the heap is at the full height, after subsidence due to compaction and loss of material by bacterial action, the heap can ferment under the untreated capping, which can be used as a base for the next heap. The heap should be kept damp, but water should not be added in quantity sufficient to cause drainage from the heap.

In summer the material should be ready for use after two months, but in cold weather the process is much slower.

Artificial manure properly prepared is very similar in chemical composition to composted horse manure, and gives equally good results in promoting plant growth.

LIME FOR THE GARDEN.

Lime fulfils many functions which are essential to soil fertility. Its most useful action is in neutralising the acidity of strongly acid soils, for with the removal of acidity the other valuable effects of liming follow. Lime improves the physical condition of heavy acid soils, ensuring better drainage and aeration, and making cultivation easier. It is an essential plant nutrient, and when present in sufficient amount promotes many phases of bacterial activity, especially those ultimately bringing the reserves of nitrogenous material in the soil into the soluble forms of nitrogen so advantageous to plant life.

There is no foundation for the common statement that exposure of acid soil to sun and air "sweetens" or reduces its acidity. Acidity is developed through an insufficiency of lime in the original soil-forming material, or by the loss of lime,

through leaching, and absorption by plants. Acidity thus developed can only be counteracted in field or garden practice by the use of some form of lime, such as hydrated or slaked lime, and ground limestone or carbonate of lime.

Slaked lime is formed by the action of water on burnt or stone lime, and forms a very fine powder which can be spread efficiently. Ground limestone is a cheaper and more pleasant material to handle than slaked lime, and can be relied on nearly always to give as quick and good results as slaked lime, provided the material is sufficiently fine and well distributed, and that equivalent dressings are applied. In the last respect, 4 lb. of carbonate of lime are required to supply as much "effective" lime as 3 lb. of slaked lime contains.

The soil to be limed should be dug over and reduced to good tilth, the lime spread uniformly and then worked lightly into the top several inches of soil. The amount of lime to be used depends on the degree of acidity of the soil, its texture, organic content, and the type of plant to be grown. Unless all these features can be determined, suggestions on the amount of lime to be added to a soil can only be approximate.

On loams and heavier soils, dressings may range from 1 lb. of slaked lime, or 1½ lb. ground limestone, per square yard on loams, to double these quantities on clay loams and clays. Sandy loams or still more sandy soils can receive lighter dressings of approximately half the amount for loams. Lime is lost most rapidly from sandy soils, which are usually more acid than heavier soils under the same conditions. Under garden conditions, with frequent waterings, lime is continually being lost, especially from the sandier types of soil. After the initial liming, which may need to be heavy to counteract strong acidity, it is preferable to add light dressings each season, rather than occasional heavy dressings.

It is not necessary always to add sufficient lime to neutralise soil acidity completely, as most garden plants grow well on slightly acid soils. This slighty acid condition will only result in the majority of garden soils after liming. Only for those plants listed below as very sensitive to acidity is it advisable to neutralise acidity completely. Whilst many plants grow best on neutral soils or on slightly alkaline soils, a considerable number of plants will tolerate fairly acid soils. The latter are not affected adversely by being grown in limed soils, though many plants which require a good lime supply may fail on acid soils.

By careful planning of the garden cropping scheme, portion of the area may be set apart and only lightly limed, if at all, for certain plants (as indicated below), and the remainder limed for those crops with a higher lime requirement. Potatoes do best on slightly acid soils, and in gardens where dry conditions are not experienced the danger from scab diseases in slightly acid soils is small.

The following statement shows the relative sensitiveness of a number of garden and crop plants to acid soil conditions:—

Very tolerant.—Potato, radish, strawberry, sweet potato, rhubarb, watermelon, pineapple.

Tolerant.—Bean, carrot, cucumber, turnip, crimson clover, maize, oats, tomato, cowpea, cabbage.

Sensitive.—Cauliflower, rape, red clover, sweet clover, wheat, white clover, lettuce, onion.

Evidence is available to show that excess of lime under certain conditions may depress plant growth. Overliming may result when the calculated amount of lime is applied to the surface zones of soil, and not worked to the proper depth. Overliming injury is produced only on heavily-limed acid soils, and not on non-acid soils, or soils which have been limed previously. This injury is not permanent and usually is overcome by the time the first crop is removed. Lettuce and lucerne are crops which may suffer from bad lime distribution.

Large additions of organic matter such as compost, manure, &c., are very effective in reducing overliming injury, and this fact is of importance in indicating that a liberal addition of green or stable manure should be applied to the soil if immediate liming and seeding are necessary. Where very heavy dressings of lime are necessary, it may be advisable to apply lime in two successive seasonal applications. After the preliminary liming, the lime added in a well-made compost will go far to counteract natural losses of lime from the soil.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF AUGUST, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and stations.	Average Rainfall.		Total Rainfall.	
	Aug.	No. of years' records.	Aug., 1937.	Aug., 1936.
	In.		In.	In.
North Coast.				
Atherton	0·87	36	1·31	0·04
Cairns	1·72	55	1·18	0·10
Cardwell	1·27	65	0·26	0·73
Cooktown	1·20	61	0·52	0·32
Herberton	0·63	51	0·42	..
Ingham	1·46	45	0·21	3·60
Innisfail	4·90	56	5·26	0·07
Mossman Mill	1·31	24	0·81	..
Townsville	0·50	66	0·01	..
Central Coast.				
Ayr	0·55	50	..	..
Bowen	0·64	66	0·05	..
Charters Towers	0·52	55	0·01	..
Mackay	1·03	66	0·31	0·13
Prosperine	1·32	34	2·68	0·35
St. Lawrence	0·80	66	0·23	..
South Coast.				
Biggenden	1·07	38	1·11	..
Bundaberg	1·26	54	1·45	0·58
Brisbane	1·96	85	1·40	0·10
Caboolture	1·51	50	1·61	0·08
Childers	1·20	42	0·80	0·13
Crohamhurst	2·17	44	2·94	0·10
Esk	1·44	50	1·09	0·16
Gayndah	1·14	66	1·40	..
Gympie	1·69	67	2·26	0·01
Kilkivan	1·40	58	1·07	..
Maryborough	1·66	66	0·89	..
Nambour	1·85	41	3·20	0·36
Nanango	1·31	55	1·41	0·08
Rockhampton	0·81	66	0·29	0·03
Woodford	1·65	50	1·42	..

Divisions and stations.	Average Rainfall.		Total Rainfall.	
	Aug.	No. of years' records.	Aug., 1937.	Aug., 1936.
Central Highlands.	In.		In.	In.
Clermont	0·68	66	0·05	0·04
Gindie	0·63	38	0·22	0·06
Springsure	1·02	68	0·25	0·10
Darling Downs.				
Dalby	1·18	67	1·51	0·40
Emu Vale	1·05	41	2·49	0·39
Hermitage	1·12	31	..	0·24
Jimbour	1·13	49	1·20	0·22
Miles	1·09	52	1·41	0·36
Stanthorpe	1·75	64	3·43	0·67
Toowoomba	1·61	65	2·27	0·06
Warwick	1·42	72	2·90	0·51
Maranoa.				
Roma	0·90	63	0·41	0·48
State Farms, &c.				
Bungeworgorai	0·74	22	..	0·40
Gatton College	1·08	38	..	..
Kairi	0·91	21	..	..
Mackay Sugar Experiment Station	0·86	40	0·48	0·10

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—AUGUST, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature. Means. Max.	Means. Min.	Extremes. Max.	Date.	Min.	Date.	Rainfall. Total.	Wet Days.
	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Coastal.									
Cooktown	29·98	77	67	82	31	59	28	52	4
Herberton	..	71	51	81	20	39	28	42	9
Rockhampton	30·13	75	54	84	20	43	23	29	4
Brisbane	30·17	70	52	78	19	44	5	140	11
Darling Downs.									
Dalby	30·18	69	44	81	20	31	6	151	7
Stanthorpe	..	61	38	73	31	22	5	343	14
Toowoomba	..	65	44	76	31	22	5	227	13
Mid-Interior.									
Georgetown	30·02	84	54	90	19, 20, 30	38	4	Nil	..
Longreach	30·10	78	49	93	31	36	3	22	2
Mitchell	30·16	71	40	89	31	29	6, 23	48	2
Western									
Burketown	30·02	83	58	90	26	49	4	Nil	..
Boulia	30·08	78	50	96	30, 31	40	3, 4, 6	31	2
Thargomindah	30·09	72	47	90	31	35	2	28	3

ASTRONOMICAL DATA FOR QUEENSLAND.

Times Computed by A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	October. 1937.		November. 1937.		MOONRISE. Oct. 1937.	MOONRISE. Nov. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	5·33	5·51	5·3	6·9	3·4	3·28
2	5·32	5·51	5·2	6·10	3·43	4·4
3	5·31	5·52	5·1	6·11	4·18	4·40
4	5·29	5·53	5·0	6·12	4·53	5·21
5	5·28	5·53	5·0	6·12	5·28	6·2
6	5·27	5·54	4·59	6·13	6·5	6·48
7	5·26	5·54	4·58	6·14	6·43	7·36
8	5·25	5·55	4·57	6·15	7·24	8·27
9	5·24	5·55	4·57	6·15	8·6	9·21
10	5·23	5·56	4·56	6·16	8·52	10·14
11	5·22	5·56	4·56	6·17	9·42	11·9
						p.m.
12	5·21	5·57	4·55	6 18	10·34	12·5
13	5·20	5·57	4·55	6·18	11·29	1·1
					p.m.	
14	5·19	5·58	4·54	6·19	12·25	1·58
15	5·18	5·58	4 54	6·20	1·20	2 58
16	5·17	5·59	4·53	6·21	2·17	4·2
17	5·16	6·59	4·53	6·22	3·17	5·10
18	5·15	6·0	4·52	6·23	4·18	6·21
19	5·14	6·1	4·52	6·23	5·21	7·29
20	5·12	6·1	4·52	6·24	6·29	8·33
21	5·11	6·2	4·51	6·25	7·37	9·28
22	5·10	6·3	4·51	6·26	8·33	10·20
23	5·9	6·3	4·51	6·27	9·46	11·4
24	5·8	6·4	4·50	6·28	10·46	11·44
25	5·8	6·5	4 50	6·28	11·37	..
						a.m.
26	5·7	6·5	4·50	6·29	a.m.	12·20
27	5·6	6·6	4·50	6·29	12·23	12·56
28	5·6	6·7	4·49	6·30	1·6	1·29
29	5·5	6·7	4·49	6·30	1·44	2·4
30	5·4	6·8	4·49	6·31	2·19	2·40
31	5·3	6·9			2·53	

Phases of the Moon, Occultations, &c.

4th Oct.	●	New Moon	9 58 p.m.
13th „	☽	First Quarter	1 47 a.m.
20th „	○	Full Moon	7 48 a.m.
26th „	☾	Last Quarter	11 26 a.m.

Apogee, 10th October, at 4 a.m.
Perigee, 22nd October, at 2 a.m.

Mercury, on the 29th, will be on the farthest side of its orbit, beyond the Sun from the Earth. Though it will be nearly 36 million miles from the Sun it will seem to be only about one degree from its disk, lost in its overpowering light.

Observers will have watched with interest the gradual approach towards each other of the two most brilliant objects in our evening sky, Mars and Jupiter. Since the middle of August, Mars has been travelling on its normal eastward course from the head of Scorpio into Sagittarius, while Jupiter has apparently moved westward, until on 15th September it resumed its direction eastward. By the end of October the little world, more nearly like our own, will be very near the giant sunlike planet. On the 30th, at 3 a.m., Mars will appear to be only 1½ degrees south of Jupiter.

Mercury rises at 4.35 a.m., 58 minutes before the Sun, and sets at 4.43 p.m., 1 hour 8 minutes before it; on the 15th, it rises at 4.56 a.m., 1 hour 22 minutes before the Sun, and sets at 5.12 p.m., 46 minutes before it.

Venus rises at 4.10 a.m., 1 hour 23 minutes before the Sun, and sets at 3.34 p.m., 2 hours 17 minutes before it; on the 15th, it rises at 4.7 a.m., 1 hour 11 minutes before the Sun, and sets at 3.55 p.m., 2 hours 3 minutes before it.

Mars rises at 10.16 a.m. on the 1st, and sets at 12.18 a.m. on the 2nd; on the 15th, it rises at 10.7 a.m., and sets at 12.1 a.m. on the 16th.

Jupiter rises at 11.40 a.m. on the 1st, and sets at 1.26 a.m. on the 2nd; on the 15th, it rises at 10.53 a.m., and sets at 12.33 a.m., on the 16th.

Saturn rises at 5.17 p.m. on the 1st, and sets at 5.31 a.m. on the 2nd; on the 15th, it rises at 4.18 p.m., and sets at 4.32 a.m.

The Southern Cross will be upright at midday on 1st October, and at its lowest position at midnight on or near the 150th meridian, and will therefore be lost to the evening sky; only the pointers are showing above the horizon.

While the fine constellation Scorpio will disappear in the west the most brilliant of all star groups, Orion, will arise in the east.

3rd Nov.	●	New Moon	2 16 p.m.
11th „	☽	First Quarter	7 33 p.m.
18th „	○	Full Moon	6 10 p.m.
25th „	☾	Last Quarter	10 4 a.m.

Apogee, 6th November, at 8·0 p.m.
Perigee, 19th November, at 11·0 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate; as the relative positions of the sun and moon vary considerably.

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ANNUAL RATES OF SUBSCRIPTION.

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VOL. XLVIII. 1 NOVEMBER, 1937. PART 5

Event and Comment

Agricultural Standards.

"IN the final analysis, we can only hold our export markets if our standards of production are at least equal in all respects to the standards of our competitors," declared the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, in the course of a recent address.

"The problems of farming," he added, "fall under three headings: (1) That which the farmer himself appreciates and solves; these are largely cultural problems associated with the varying phases of routine farming practice. (2) That set of problems needing for their solution the co-operation of the producer and the Department—the Department to instruct and the farmer to apply; and (3) that set of intricate questions that are by their very nature entirely within the province of the research officer. Agricultural research is at the root of all progress. Stability, advancement, and, indeed, preservation, all demand a vigorous research policy, and to-day the research division, in close association with the various other branches of the service, are engaged on work in connection with cotton, maize, wheat, peanuts, tobacco, fruit, grasses, fertilizers, soil research—chemical and bacteriological—and indeed in all branches of production.

"One of the happiest indications for the future is the degree of co-operation we are able to obtain from the farmer. The day of the centralised experiment farm is past, and the best work being done is on the farm plot situated on the holding of an approved farmer. It is clear that such co-operation is essential, if a successful programme of work is to be carried out."

Agriculture in Queensland.

IN his annual report to the Minister, the Under Secretary and Director of Marketing, Mr. E. Graham, makes a general appraisal of the agricultural and live stock situation in Queensland. It is clear, he remarks, that farmers as a body appreciate the value of technical advice, and that they are eager to make full use of the instructional services of the Department. They are realising the importance of soil conservation—the prevention of erosion by wind and water. A wider appreciation of the fact that correct fertilization means something more than the mere application of crop stimulants is evident. The storage of plant foods in the soil as sound practice is recognised to a greater extent. Rotational cropping and grazing in our farming system is becoming more general. The belief that success in agriculture can only be achieved by planned methods is well established. The necessity of making provision against fodder shortage has been demonstrated to a greater degree than at any other time in the history of the industry. Protection and improvement of native grasses have been bracketed with the establishment of sown pastures of proved stock-feeding value. Swards of introduced grasses are extending widely, especially in areas where climatic and other conditions are conducive to their rapid growth. The necessity of correct pasture management and the evils over grazing are kept continuously before stockowners.

A systematic campaign for livestock improvement and the raising of standards of animal husbandry has been entered upon. The control and eradication of stock diseases have been continued with vigour.

Soil erosion, as one of the greatest menaces to rural industry, is receiving the earnest attention of the department, and for the purpose of devising practical schemes of prevention the Soil Erosion Committee was brought into being.

The Government, fully cognisant of the importance of agriculture in the economy of the State, once again came to the assistance of farmers, who through the stress of seasonal adversity were forced to look beyond their own boundaries for fodder, either to maintain dairy herds in production or minimise stock losses in districts where the drought was most severe. An effective organisation was established in co-operation with butter factory directorates. Molasses and other food materials were supplied at bare cost at reduced transport rates. This prompt action in a time of emergency helped materially to tide the dairy industry over a period of very great difficulty.

Once again it is very pleasing to be able to record an excellent spirit of co-operation between the department and every section of primary producers. A continuance of this spirit of mutual help is obviously essential to the progress of the State. It is felt, however, that the Department should not be regarded as of use only in time of need, and that it should be realised more widely that the work of the Department has been planned with the object of ensuring better conditions for the whole countryside. It is, therefore, to the advantage of the entire body of producers to make full use of the facilities provided for them.

Agriculture the world over is confronted with special and extremely intricate problems, of which the marketing and distribution of primary products remain among the most perplexing. To be reasonably profitable, primary industry must have prices for its products which are higher than its fixed charges and production costs. This is plainly impossible when supplies greatly exceed effective demand. In this connection, it is interesting to observe the world-wide growth of economic regulation, not only in trade but in production. In an entirely altered world economic system, a purely competitive and wholly unregulated agriculture can no longer survive. The necessity of readjustment of agriculture to permanently changed conditions has to be accepted. A truism worth repetition with emphasis is that, if economic equilibrium between market prices and production costs is to be attained, a concentration on production costs is a necessity; but not, of course, at the expense of the quality of the product.

Farmers have become impressed more deeply with the importance of the business side of the land industries. The necessity of economic foresight and insight has been forced upon them.

The days of extensive farming are rapidly passing. Intensive farming is taking its place. With the passing of the years competition for markets is becoming keener, and only products of the highest quality can maintain their hold.

In the further development of agriculture and related industries in Queensland, due appraisal must be made of all the factors influencing production, manufacture, marketing, and distribution. There is nothing static about the policy of the Department. Reorientation to constantly shifting situations is often essential. New problems arise and have to be faced. An elasticity in policy must, therefore, be conceded, for pace must be kept with changing conditions and requirements. Agriculture, consequently, is subject to continuous economic investigation and adjustment to altering circumstances.

Animal Health.

THE work at the Animal Health Station, Yeerongpilly, progressed steadily during the year. This applies particularly to the tick-fever inoculation work in respect of the number of stud animals inoculated, bleeders, and doses of blood supplied.

Investigational work in connection with the recent outbreak of "three-days' sickness" is being carried out with the co-operation of the entomological and veterinary staffs of the Queensland University and the Council for Scientific and Industrial Research. In co-operation with the Health Department, experiments are in progress for the purpose of investigating the aetiology and pathology of "Q" fever. In conjunction with the Agricultural Chemist, work also is proceeding in connection with cattle losses due to the saw-fly larvæ.

A wide variety of diseases affecting the domestic animals and birds were encountered in addition to those mentioned, and the following are among the most important:—

Arsenical poisoning in cattle and sheep; ergot poisoning in cattle; plant poisoning in cattle and sheep; contagious pneumonia in pigs; hæmorrhagic septicæmia of pigs; posterior paralysis of pigs; filariosis of dogs; bacillary white diarrhœa of chicks; coccidiosis of poultry; and blackhead in poultry.

The Use of Acetylene to Induce Flowering in Pineapple Plants.

H. K. LEWCOCK.

IT has long been known that pineapple plants may be induced to flower prematurely by exposing them to smoke fumes for periods ranging from twelve to twenty-four hours. For many years pineapple growers in the Azores have taken advantage of this knowledge to control the blossoming period of their crops by using smudge pots in their glasshouses. From time to time, growers in Queensland have reported premature flowering in pineapple plants which have been exposed to smoke from neighbouring bush fires. In several instances this has occurred in suckers even prior to planting. It was not until comparatively recently, however, that the action of smoke in stimulating flowering was investigated. One of the constituents of wood smoke is a gas known as ethylene and it has been found that it is this gas which provides the stimulus which causes flowering when pineapple plants are exposed to smoke. Researches conducted in Hawaii have shown that acetylene gas is equally as effective as ethylene in inducing flowering in pineapples and that it is both cheaper and more convenient to use under field conditions, since it can be dissolved in water and applied in that form. This is the method of application which has been adopted in Hawaii and which is now recommended for use in Queensland. Applied in this manner, the acetylene treatment has not been found to exert any adverse effect either on the plant itself, its sucker growth, or on the quality of the fruit it produces. (Plate 216.)

Advantages of the Acetylene Treatment.

In Hawaii the acetylene treatment has found general application, firstly, as a means of spreading the harvest peak over a much longer period than it normally occupies and, secondly, as a means of forcing would-be "holdover" plant crop and ratoon plants into flower.

Under Queensland conditions, the acetylene treatment possesses obvious possibilities not only as a means of supplying market requirements for fresh pineapples at times when supplies are normally inadequate, but also as a means of reducing cannery losses from black heart and brown speck by advancing the ripening period of a large proportion of the winter crop from July and August to April and May.

Experiments have shown that, by the use of the acetylene treatment, it is possible to force plants into flower during October and November which normally would not blossom until the following February and March. Plants which flower during the latter months produce fruits which ripen during July and August and these, because of the short day periods, low temperatures and other unfavourable climatic conditions during ripening, are of poorer quality than those harvested at any other time of the year. Moreover, largely because of their low sugar content, fruit which mature during these months are particularly subject to black heart and other internal diseases. By forcing the plants which bear this fruit to flower some three or four months earlier, they would mature their crop during March, April and May, at which time climatic conditions are favourable for the production of yellow-fleshed fruit of high sugar content. Advancing the flowering period

Plate 216.

Acceleration in time of fruiting of pineapples resulting from treatment with acetylene. The fruiting (acetylene treated) plants in the foreground were planted at the same time as the untreated plants at the rear.

of such plants may therefore be expected to result in a marked improvement in the quality of their fruit and, at the same time, greatly reduce losses from black heart and other winter diseases. For reasons of quality alone, however, it seems highly desirable that the bulk of the pineapples intended for canning should be harvested during the months of February to May, and the fact should not be lost sight of that the production of high quality fruit results in a higher net return to the grower, since a higher canning quality is synonymous with an increase in weight per unit volume of fruit. In Hawaii, approximately 95 per cent. of the crop is harvested during the summer and autumn months, not because of climatic and other chance factors, but because production methods have all been designed to achieve this very desirable objective. Moreover, plants which fruit at this time of the year customarily produce many more slips than those which fruit during the winter months and slips are generally recognised as the preferred type of planting material.

Precautions to be observed in using the Acetylene Treatment.

Because acetylene gas can be dissolved in water, it has been possible to devise a very simple, cheap and efficient method of using it on pineapple plants. Approximately one-eighth of a pint of a saturated or nearly saturated solution of the gas is introduced into the heart of each plant or sucker, where it is retained in contact with the growing point by means of the "cup" formed by the upper whorls of leaves. Provided no rain falls within twenty-four hours, only a single application of the solution is necessary to induce flowering to take place. Should rain fall during this period, however, the treatment must be repeated. Since dew collecting in the cupped heart leaves dilutes the acetylene solution in the same way as a shower of rain, it is usually undesirable to apply the solution during the forenoon.

One cubic foot of water will dissolve approximately the same volume of acetylene gas, but even this relatively small degree of solubility is not readily obtained unless the gas is confined in an enclosed space under pressure. Since undue pressure will cause acetylene gas to explode spontaneously, it is necessary to observe certain precautions in preparing the solution. If the instructions which follow are strictly adhered to in every detail no risk whatever is entailed in using the acetylene treatment. However, unauthorised or haphazard methods of preparing the solution may result in serious accident and therefore should be avoided.

Procedure used in conducting Experimental Trials.

In the experiments and trials which were conducted during last spring and autumn, a method of preparing the solution was employed which involved introducing a weighed quantity of carbide into a petrol drum partly filled with water and, after replacing the bung, agitating the drum until a saturated solution of the gas was obtained.

Publicity was not given to the details of this method because it involves careful calculation of the quantity of carbide required, since this varies with the cubic capacity of the drum employed and the extent to which it is filled with water. A slight excess of carbide results in a rapid increase in pressure within the drum and if this should exceed 30 lb. per square inch the gas will explode spontaneously. While of value for experimental purposes, this method is obviously unsuitable for general use.

Procedure Recommended for Preparing the Acetylene Solution.

After the effectiveness of the acetylene treatment under Queensland conditions had been demonstrated by experimental trials, attention was given to devising a safe, simple and efficient method of using it under the limitations imposed by local farming practices. The method about to be described has been found to meet all these requirements. It has been worked out with the co-operation and assistance of the Queensland Oxygen Pty. Ltd., whose engineers have thoroughly familiarised themselves with the field aspects involved.

Plate 217.
Equipment set up for preparing acetylene solution.

In this method, which is the only one recommended at present, compressed acetylene gas contained in a special type of steel cylinder is conveyed into a petrol or oil drum filled with water until a saturated solution of the gas is obtained. This is accomplished in the manner depicted in the accompanying diagram (Plate 218). The steel cylinder (A) is connected to the petrol or oil drum (B) by means of rubber tubing (C). As the gas leaves the acetylene cylinder it passes through a regulator and pressure gauge (D) which controls the flow at a fixed pressure, namely, 9 lb. to the square inch. As a special safety precaution, this regulator is so arranged that when the pressure exceeds 15 lb. per square inch the gas automatically blows off to atmosphere by means of a safety valve. It is particularly important

that the adjustments on this regulator should not be tampered with in any way, since they have been set to give the maximum degree of efficiency and safety.

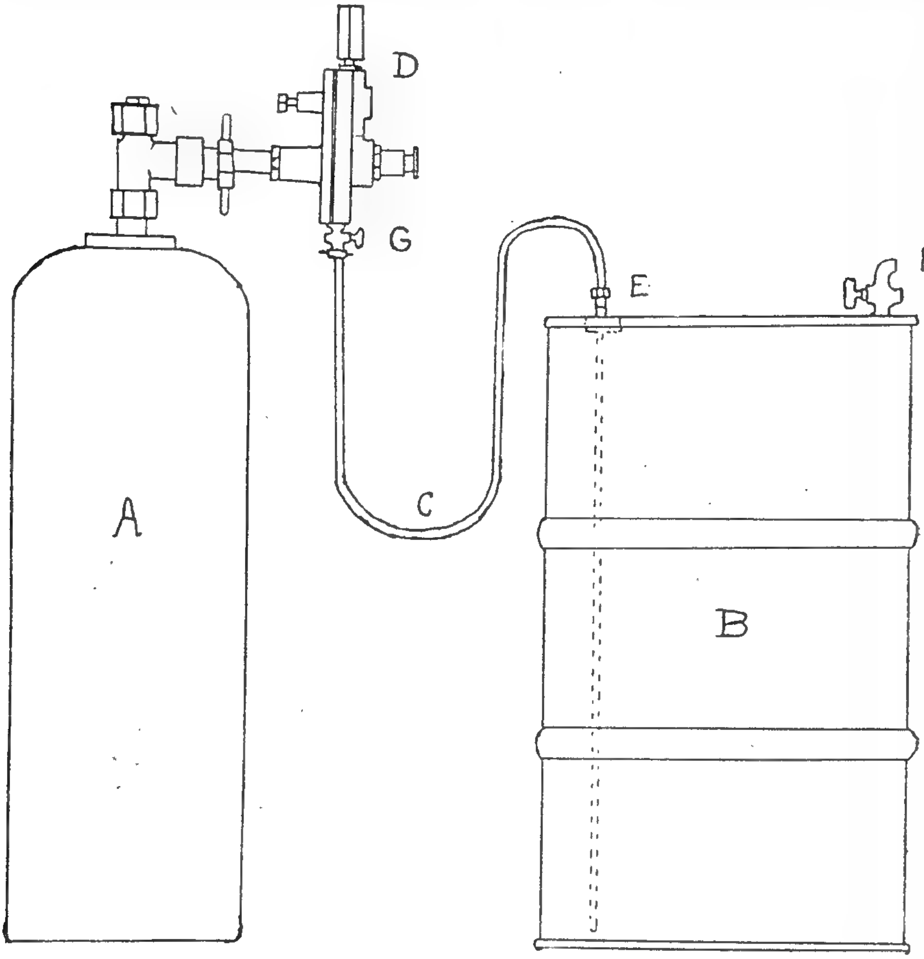

Plate 218.
Diagram of equipment for preparing acetylene solution.

Method of Preparing and Applying the Acetylene Solution.

In operation, the rubber tubing which proceeds from the regulator is connected to a fitting (E), which in turn screws into the large bunghole of a 44-gallon petrol drum filled with water to within about 4 inches of the top (approximately 40 gallons). If the drum used is of the type in which the large bunghole is on the side instead of on one end, the copper tubing attached to the fitting (E) must be shortened accordingly. Before using a new drum, it is important that all dregs of petrol should be thoroughly washed from the drum by filling it to overflowing with water.

After the equipment has been connected up in the manner indicated and the cock (G) on the bottom of the regulator has been turned to the "on" position, the valve on the gas cylinder is opened carefully by means of the cylinder key which is provided. This key should not be given more than one full turn; a half turn or less will usually provide

an adequate flow of gas. As soon as the gas is turned on, the water in the drum is agitated by rocking the drum from side to side until the needle on the pressure gauge registers a pressure of 9 lb. per square inch. The gas flow should then be turned off at the cylinder valve by means of the cylinder key and the drum should be further agitated until the needle on the gauge falls to zero. This operation is repeated until the needle on the pressure gauge no longer drops when the drum is agitated, but remains stationary at from 7 lb. to 9 lb. pressure. At this stage, which should be reached in from five to ten minutes, the water in the drum is fully saturated with acetylene and the solution is ready for use. Before it can be drawn from the drum, however, the cylinder valve must be turned off tightly, the cock on the regulator shut, and, with the drum standing on its end, the water tap (F) opened to allow any free gas contained in the drum to escape. When this has been done, the rubber tubing leading from the drum should be disconnected from the regulator and the water tap (F) closed, after which the drum may be laid on its side to permit of easy withdrawal of the solution.

From the drum, the solution is run off through the tap (F) into the containers from which it is to be applied to the plants. An ordinary knapsack or pneumatic sprayer may be readily adapted for this purpose by replacing the normal nozzle with a 3/16-inch jet fitted with a trigger release (Plates 219 and 220). The tanks supplied with certain types of flamethrowers are even better suited for applying acetylene solution, since they are designed to hold a relatively high pressure with only intermittent pumping. Consequently, when using the latter type of equipment, one hand is free to move away obstructing leaves, and the application of the solution is thereby greatly facilitated. (Plate 221.) If neither of these containers is available, however, the solution may be applied from a bucket by means of a long-spouted coffee-pot or similar utensil.

Irrespective of the type of equipment which is employed for applying the solution, care should be exercised to introduce it squarely into the hearts of the plants which it is desired to force into flower. Each plant should receive sufficient solution to fill completely the receptacle formed by the cupped heart leaves. In practice, it will be found that one gallon is ample for sixty applications.

It is more satisfactory to prepare the acetylene solution at or near the tank or well from which the drum is filled, rather than in the plantation itself. A convenient method of arranging this is to mount the drum on a truck or slide so that it can be easily and quickly transported to and from the field. Such an arrangement has an additional advantage in that the clearance provided between the bottom of the drum and the ground facilitates the filling of the containers employed for applying the solution to the plants, particularly when the solution in the drum is nearing exhaustion. Agitation of the drum while the solution is being prepared is likewise facilitated by standing or laying it on a short piece of round wood about the thickness of a broom handle.

Cost of the Acetylene Treatment.

Approximately 2,400 plants can be treated with each drum full of solution, viz., 40 gallons. Since slightly less than 8 cubic feet of gas are required to saturate this quantity of water, a cylinder containing

Plate 219.

Applying acetylene solution by means of a knapsack sprayer. Note that one hand is continually engaged in operating the pump.

100 cubic feet of compressed gas should provide sufficient acetylene to treat at least 30,000 plants. At current prices, this would entail an expenditure for materials of approximately 8d. per 1,000 plants.

Plate 220.

Trigger release and jet recommended for the application of acetylene solution from a knapsack sprayer or flamethrower.

Age at which the Acetylene Treatment may be applied.

By means of the acetylene treatment, pineapple plants can be forced into flower at any stage of their growth provided climatic conditions are favourable at the time the treatment is applied. However, the size of the fruit which will develop is determined by the size and vigour of the plant or ratoon receiving the treatment. Even under

the most favourable growth conditions plants are rarely large enough for treatment before they are ten or twelve months old. (Plate 222.) When treated at this age, well-grown plants should yield fruit corresponding in size and weight to those which are normally obtained from untreated plants. Plantings made in the late spring or early summer

Plate 221.

Applying acetylene solution by means of a flamethrower. Note that the type of pump employed permits the operator to use one hand for moving away obstructing leaves.

Plate 222.

Application of acetylene solution to a replanted field at Woombye (planted December, 1936). Young plants should not be treated before they have attained a stage of development similar to that depicted above.

Plate [illegible].
Partially-developed fruits on acetylene-treated plants in the Dayboro' district. Treatment applied 29th October, 1936; photographed [illegible] April, 1937.

of one year will usually be sufficiently advanced for treating at about the same time in the following year. Suckers in ratoon fields should be similarly well developed before the acetylene treatment is applied.

The production and development of suckers and slips is not affected in any way by the acetylene treatment, provided discrimination is exercised in regard to the size and vigour of the plants to which the treatment is applied. The extent to which these vegetative organs are produced depends almost entirely on inheritance factors and on the vigour of the parent plant.

Time of Application.

Field experiments indicate that, under the climatic conditions existing in Southern Queensland, response to the acetylene treatment is likely to be uncertain if it is applied before the middle of September or after the middle of March. Applications made between these months should induce flowering in from six to eight weeks. Following earlier or later applications, however, the interval between treatment and flowering is considerably lengthened, and may run to twelve or fourteen weeks. Moreover, while late spring and summer applications may be expected to prove between 80 and 100 per cent. effective, those made during the colder months are likely to prove most unreliable and sometimes wholly ineffective.

Despite these limitations the acetylene treatment will probably be found to meet all normal requirements. Plants treated early in November should mature their fruit during May (Plate 223), a time when supplies are frequently inadequate for the needs of the fresh fruit markets; while it appears likely that the usual November-December shortage can be met by treating holdover plants or suckers during February. Applications made during the first half of March are almost equally effective as those made earlier in the summer, but the fruits which develop from these late applications may not mature until the following Christmas or New Year and, in addition, they are likely to be "prickly-eyed."

It will be noted that there is a wide variation in the interval which elapses between the application of the treatment and the ripening of the fruit, according to the seasonal conditions which obtain during this period. It appears that the rate of development of acetylene-forced fruit is influenced by seasonal conditions to the same extent as that produced on untreated plants.

"Don'ts" to be observed in Using the Acetylene Treatment.

Don't treat plants or suckers until they are large enough to bear profitable fruits.

Don't expect satisfactory results from applications made during the autumn or winter months.

Don't treat plants for at least twenty-four hours after rain has fallen, nor when rain is threatening.

Don't smoke or strike matches while preparing the solution—acetylene gas is highly inflammable.

Don't employ any but the recommended method for preparing the solution—acetylene gas explodes spontaneously above 30 lb. pressure.

Don't fail to read the instructions *carefully*.

Diseases of the Papaw.

J. H. SIMMONDS, M.Sc., Senior Research Officer.

UNTIL recent years there has been but little attention focussed on papaw diseases in Queensland, with the result that although the cause of most of them is now known control measures have not yet been worked out in all cases. As would be expected from the soft nature of the fruit, transport rots are a source of considerable loss. The development of disease is aided in Southern Queensland by winter conditions, which are often too severe and variable for a tropical plant such as the one under discussion.

BLACK SPOT.

Black spot is widely distributed throughout Queensland, where it is probably the most serious disease to which papaws are subject. All the aboveground parts of the plant, with the exception of the leaves, may be affected.

On the fleshy white flowers and very young fruit there develop brown areas of decay which later turn to conspicuous, dark, shrunken spots (Plate 224). The infection often extends back until the stalk is invaded, when the flower or fruit will gradually shrivel up. Fruit older but still green may exhibit a black, circular spot limited in extent to an inch or an inch and a-half in diameter. This type of infection usually occurs where two fruit touch or where a leaf has been lying. In mature fruit the rot takes the form of one or more circular brown spots, distinct or coalescing, which appear on the exposed side of the fruit (Plate 226). This form of injury will be discussed more fully under the heading of ripe rots.

A serious loss arises from the invasion of the main stem. This is usually the result of the disease working in through a decaying flower or fruit stalk, or through the point of attachment of a dead leaf (Plate 224). The dying leaf stalks often act as a source of infection in this way, especially if death has been premature due to winter injury. A somewhat shrunken, brown or black area of decay is set up, and this may extend for some distance and completely cincture the stem so that the upper part of the tree dies.

Studding the surface of the dark, decayed areas are often minute pimples or pustules from each of which a white gelatinous tendril issues in moist weather. The pustules are the flask-shaped fruiting bodies of a fungus (*Ascochyta caricæ*), and the white exuded substance consists of a mass of minute two-celled spores. By inoculating pure cultures of this organism into healthy plants it has been shown to be the cause of the disease.

Black spot is serious during the winter and spring months. In May and June some decay of young flowers and fruit may occur. Later the black spot on green fruit may be in evidence and the ripe rot cause loss in fruit colouring on the tree and during transport. As the weather warms up in the spring and growing conditions improve the disease lessens gradually, and towards the end of the year losses are less serious.

Exposure and cold appear to favour the development of the disease. The papaw is a tropical plant, and if grown in cold, exposed situations, will lose most of its older leaves during the winter months.

The dying leaf stalks afford an opportunity for the fungus to gain entrance to the stem. Also, owing to lack of protection the fruit is exposed to cold winds and the heat of the sun, thus predisposing it to infection. In this connection, it is important to note that maintaining a vigorous growth by the application of suitable cultural methods will reduce the extent of winter leaf injury.

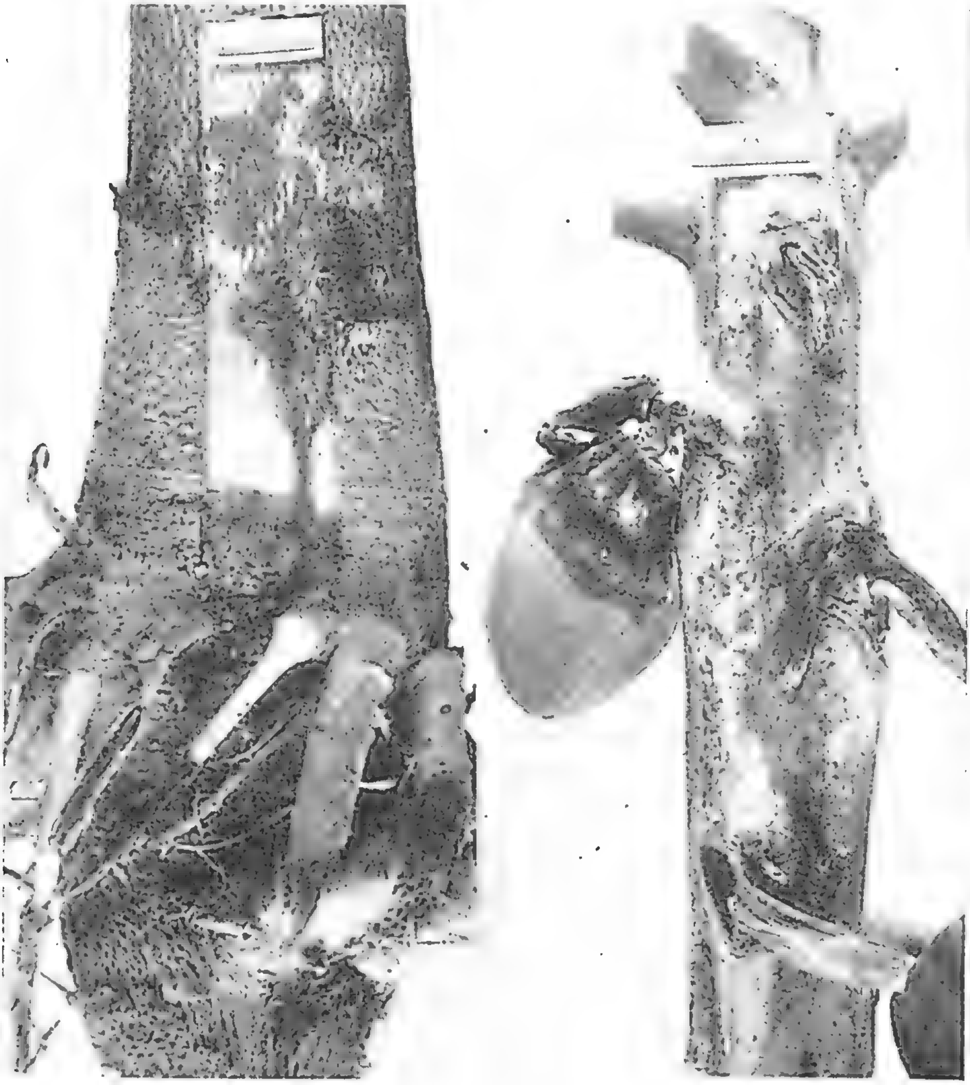

Plate 224.

Left—Papaw affected with foot rot; a strip of bark removed to show the rot below.

Right—Black spot attacking a young fruit and entering the stem through dead leaf stalks. (Note the decay commencing at the point of insertion of the two lower leaf stalks).

Control.

A satisfactory spraying programme for the control of black spot has not yet been worked out. A Bordeaux spray has to be avoided, as it may cause a scorching of the young crown leaves. Only where powdery mildew is also serious can spraying be definitely recommended. It is then suggested that a wet spray of either lime-sulphur, 1 in 35,

or colloidal sulphur be applied at approximately monthly intervals, commencing in April and ending in September. A suitable spreader should be added to the spray.

Choose a warm, sheltered situation for papaw growing. Fertilize well in order to obtain a vigorous growth resistant to winter injury. The fertilizer should contain an adequate supply of potash when the plants are in fruit.

Collect and burn any dead leaf stalks which may be removed without injury to the fruit, and also remove spotted fruit from the vicinity of the plantation and packing shed.

Cut off plants affected with stem rot below the point of injury, if possible at one of the stem partitions, with the object of forming a new fruiting stem by a lateral shoot from below.

POWDERY MILDEW.

Powdery mildew is caused by a fungus (*Sphærotheca sp.*) which attacks only the younger parts of the plant. The young crown leaves of an affected tree have a yellow, blotched appearance as a result of the presence of numerous light yellowish-green patches. The lower surface of these is usually speckled with small water-soaked dots, or the whole may have a distinctly water-soaked appearance. By means of a lens, delicate cobweb-like fungous threads may be seen spreading over the surface, usually on the under side. During moist or showery weather short chains of delicate oval spores are given off from these threads, which, in a mass, form conspicuous white floury patches. On rare occasions a second type of spore body appears as scattered grey specks along the main veins and leaf stalk.

Affected leaves often outgrow the disease if the infection is light, but, with the fungus present in abundance, dead areas appear between the main veins and along the margin, giving a brown, scorched appearance to the young leaves. This may result in a severe setback to young trees, and may even cause their death.

Patches of the white floury mildew develop on the young fruit also. In this case, the fruit is rarely killed and the fungus gradually disappears. However, the skin reacts to its presence to produce a superficial grey scar which may be of large size and seriously mar the appearance of the mature fruit. Growth is restricted over the affected area, so that malformation often results as well (Plate 225).

Powdery mildew is mainly a winter trouble. It becomes well established rather earlier than black spot, usually in May and June, and disappears with warm summer growing conditions. There appears to be a definite variation in the susceptibility of individual plants to this disease.

Control.

The fungus causing powdery mildew lives mainly on the outside of its host and, consequently, can be controlled with comparative ease by a sulphur spray or dust. If black spot is present also, the wet spray is preferable. Lime-sulphur 1 in 35 or colloidal sulphur may be used. The addition of a spreader is advisable, since without one it is difficult to cover the young growth. For powdery mildew alone, dusting is to be preferred on account of the ease and speed of the operation. A simple dust containing about 50 per cent. sulphur with lime as a filler is suitable.

It is necessary to concentrate on the young crown leaves and fruit, covering the under surface of the leaves thoroughly. Applications should commence about May, or as soon as the disease makes an appearance. The wet spray will need to be repeated once a month or every six weeks until the end of August. The dust must be applied more often, especially if rain storms are frequent or if the disease appears to be on the increase.

Plate 225.

Powdery mildew of the papaw, showing the fungus growing on a young fruit and the scarring and malformation which develops later.

RIPE ROTS.

The spring and early summer crop may suffer severely from one or more types of ripe rot. Circular brown spots develop in varying numbers on the skin of the mature fruit. These range in size from small, shallowly-depressed spots to large, saucer-shaped depressions an inch or more in diameter. In some cases there may be an exudation of latex into the hollows of the depressions, giving a scabby appearance to the fruit.

This distinct spotting is often preceded by a superficial brown discolouration of the skin, producing a scald-like effect. In some cases this appears to be a true scald brought about by exposure resulting from winter leaf fall, but in other cases it represents an early stage in the development of the ripe rot spots themselves. These, before becoming depressed, appear as small, circular, brown stains on the skin, and, if numerous, may spread and become confluent to form the brown discolouration described above.

Ripe rot of the papaw may be caused by at least two distinct fungi—*Ascochyta caricæ* and a species of *Glœosporium.* In the early stages there is little difference in the spotting produced by these two organisms. In the later stages they are usually distinguishable by the appearance of two distinct types of fruiting body over the surface of the spots. In the case of the former these consist of minute, raised pustules produced on a greyish or black background from which a white pin-point mass of spores is exuded in wet weather. The latter produces pinkish masses of spores which may form a continuous pink layer over the centre of the spot. In the Ascochyta spot the tissue immediately below the surface is firmer than the normal flesh and often conspicuously grey. With a Glœosporium infection there is little change in colour (Plate 226).

Mature fruit may develop the brown scald and spotting while still on the plant, or, as is often the case, apparently sound fruit will become spotted on reaching the market, especially when consigned for long distances. In either case the spots develop typically on the side which on the tree is the exposed outer surface of the fruit. A stem-end rot sometimes follows infection through the wound left by breaking the fruit from the stalk.

Both the abovementioned organisms live and produce spores on dead and dying leaf stalks, and it is probable that much of the infection is derived from this source. Unfortunately, it is usually impossible to remove the leaf stalks without injury to the fruit.

Control.

As the development of the ripe rots appears to be bound up with winter injury, any practice calculated to minimise this is advisable. A satisfactory spray has not yet been found, and recommendations are largely a recapitulation of those suggested for black spot.

1. Select a warm locality and fertilize when necessary, in order to reduce winter injury.

2. Practise sanitation measures as far as possible.

3. Apply a sulphur spray during the winter and spring months if powdery mildew is also present and needing control.

4. Attend to correct picking maturity, as the delayed ripening of immature fruit increases the incidence of ripe rot.

Plate 226.

Papaw Fruit Diseases.

A. The type of papaw ripe rot produced by *Glœosporium sp.* B. Watery rot, showing an abundant development of the fungus *Rhizopus nigricans* on the soft area. C. A well-developed black spot lesion on mature fruit.

WATERY ROT.

Fruit, after it has been picked, occasionally develops a soft, watery decay which rapidly involves a large proportion of the flesh. Apart from a water-soaked appearance, no discolouration is present. The rot is commonly associated with some form of injury, and often with old black spot lesions. It is caused by a common mould fungus (*Rhizopus nigricans*) which may produce wefts of long, grey, fungous threads over the surface of the soft area. In advanced stages these threads may bind fruit and packing material together into a ''nest'' (Plate 226).

No special control measures are necessary. Fruit should be handled carefully so as to avoid injury, and any damaged or spotted fruit should be omitted from long-distance consignment. Sanitary precautions such as the destruction of rotting fruit in the plantation and packing shed should be taken.

FOOT ROT.

It is essential that papaws be grown on well-drained land; otherwise, during periods of prolonged wet weather, the roots are liable to decay and cause a wilting and death of the plant. This is the result of loss of aeration owing to the waterlogged state of the soil.

There is, however, a definite disease giving rise to a somewhat similar condition. The base of the stem near ground-level develops a soft, spongy rot which may involve the main roots and extend upwards in brown tongues of decay within the pith and woody parts (Plate 224). Externally, except for a dark and somewhat water-soaked appearance of the bark, there is often little to attract attention. The final effect is a wilting or gradual decline of the plant.

This rot is caused by a fungus (*Pythium ultimum*) which can sometimes be seen forming a white, mould-like growth on the bark covering the rotting region, and also masses of fine fungous threads in the adjoining pith cavities. Both young and old plants are affected by the disease, which usually appears only in fairly isolated cases.

Control.

1. Dig out and burn the stem of any plants developing this disease in order to prevent further spread. Do no replant in the same hole for some time.

2. Avoid injuring the base of the plant during cultivation, as the fungus may gain entrance through the wounds.

3. If the land is flat and liable to flooding, young plants should be set out on hills.

YELLOW CRINKLE.

In a plant affected with yellow crinkle the older leaves exhibit a yellow colour and the petioles take up a characteristic drooping habit. The young leaves develop thin, translucent areas along the margin and between the main veins and, as they expand, these weak chlorotic portions break away, leaving holes in the leaf and a ragged margin. These leaves as they mature have a somewhat hard and crinkled appearance, and usually remain a lighter yellowish green. The very young leaves are characterised by a talon-like incurving of the tips of the segments (Plate 227). Gradually the older foliage falls off, leaving a bare stem crowned with a few stunted leaves conspicuous by their

puckered appearance and indented margin. The floral parts, if present, may develop into abnormal foliage-like structures. Although the plant often remains in this condition for some time, fruit formation rarely occurs.

Yellow crinkle usually makes its appearance during the late summer. The disease is commonly restricted to scattered individuals, but as high as a 25 per cent. infection has been recorded. It is apparently more serious following a period of drought.

A. B. C.

Plate 227.

YELLOW CRINKLE OF THE PAPAW.—A. Portion of the crown of a healthy plant for comparison. B. Abnormal development of a flower. C. Yellow crinkle symptoms in the crown leaves of a diseased plant. Note the broken margin and incurved end of the segments.

The exact cause of yellow crinkle has not been proved definitely, but its characteristics suggest that it may be due to an infectious virus, as is the case with bunchy top of the banana. This type of disease is usually spread by transferring sap, in which the virus is present, from a diseased to a healthy individual. In the present case it does not appear possible to effect a mechanical inoculation by means of the hands or implements, and it is likely that certain sucking insects are implicated in the spread of the disease. Normally, very few insects of any description are to be found on the papaw, which may account for the fact that yellow crinkle is sporadic in its appearance.

Control.

From the point of view of control it would be wise to assume, as the evidence suggests, that this disease is of a virus nature. If this be so, it is useless to expect a cure, and it becomes necessary to eliminate the source of the virus by digging out any affected plant as soon as it is noticed. The crown of the plant should be sprayed before removal with kerosene or strong nicotine sulphate solution to kill any infective insects present. Although it is not uncommon for one crown of a branched tree to be affected first, it is unwise to destroy only this one, as the disease usually appears later in the remainder.

DIEBACK.

A papaw tree affected with dieback exhibits a general yellowing of the leaves accompanied by the death of a few of the younger ones, either completely or in segments only. The dark shrivelled areas on these centre leaves may continue down the petiole to a dark brown rather dry area of decay at the tip of the stem. This dead area on the stem does not usually extend for more than a few square inches and, unlike the lesion caused by black spot, is fairly shallow and apparently unoccupied by any parasitic organism. Eventually, all the leaves wither and die, and any fruit present ripens abnormally or else softens and falls off green. A tree with several branches may have one or more branches die.

This trouble affects both young and old trees and those in vigorous as well as in poor condition. It is most prevalent during protracted dry spells, and appears to be more immediately related to periods of hot, drying winds. Nematodes and a root rot from which *Phythium ultimum* has been isolated may accompany the dying of the tops, but not consistently.

It is for the present considered that this disease is a physiological trouble somewhat akin to blossom end rot of tomatoes. During a dry season, when soil moisture is low, and especially if the efficiency of the roots is depleted by the presence of nematodes or decay, a period of hot, drying weather will cause the plant to transpire from its leaf and fruit surface more moisture than the roots can immediately replace. The deficiency may be partly made up by drawing on the supply in the soft, sappy tissue of the stem apex and young leaves. If the drain is too great these parts will collapse and eventually die.

A partial root rot, following excessive rain, by producing artificial drought conditions, has also given rise to similar symptoms.

Control.

Where possible, careful irrigation so that the soil does not become too wet or too dry should minimise loss from this trouble.

In many cases an affected plant will send out healthy lateral shoots from farther down the stem. If, therefore, the dead top is cut off at one of the stem partitions, a new fruiting stem will often be formed to replace it as soon as growing conditions improve.

FOWL MANURE.

Poultry are usually fed a ration rich in protein, and consequently their excrement is rich in nitrogen. The arrangement by which intestinal and kidney waste products are voided together makes the nitrogenous products of fowl manure largely soluble.

It follows that care must be taken in storing fowl manure to see that no loss by leaching occurs. This may be done by storing it under cover in peaked heaps, or by mixing it with sand or friable earth which will absorb the soluble plant food.

Its high nitrogen content makes fowl manure a forcing fertilizer—usually termed "strong"—so that while its use for rapidly growing vegetables and strawberries is advocated, admixture with superphosphate and potash is advisable for most other crops.

Insect and Allied Pests of the Papaw.

J. HAROLD SMITH, M.Sc., N.D.A.

THE papaw is subject to a fairly wide range of pests, all parts of the plant being attacked. Some, such as the red spider, can be expected in most districts every year; others, such as the fruit-spotting bug, are only troublesome occasionally. Only the more important pests are discussed here.

THE RED SPIDER.

The red spider* is a mite known to attack a variety of hosts. The name is rather misleading, for the colour is seldom red, greyish green being dominant, although the actual shade varies greatly even within a single colony.

The leaves of affected plants show symptoms comparable with dry weather effects; the margins curl, the colour is bleached, particularly near the main veins, and reddish brown blotches may appear in the final stages of an attack. Normally, infestation commences in the older leaves, and then spreads to the younger growth. These symptoms are the result of mass feeding by very large numbers of mites on the under surface of the leaves. The fruits may also be infested, but this type of injury is of slight importance compared with the impoverishment associated with extensive leaf injury.

When infested leaves are closely examined, all stages of the mite from the microscopic egg to the very minute adult can be observed on the under surface. Silken threads are spun by the adult, and illustrate a characteristic habit of this and some related species, from which they have acquired the name "spinning mites."

Growth is very rapid, particularly in summer, when the period between egg and adult is approximately only a fortnight. Because of its high reproductive rate, an attack may develop very quickly. Red spider outbreaks are, however, usually sporadic, acute one month and negligible the next, but a whole season's growth may nevertheless be disturbed by a single attack. These marked fluctuations in the red spider populations are usually attributed to the mite's sensitivity to climatic changes, warm dry weather being favourable for a rapid increase, while cold temperatures with or without heavy rain retard development. In coastal Queensland, red spider infestation is frequently worst in spring when the weather is relatively dry with comparatively warm days.

Although predators are frequently active on red spider infested plants, they cannot be relied upon to keep the pest in check, and control measures are often necessary. Fortunately, the red spider is by no means difficult to control, and either a lime sulphur spray or a sulphur dust can be used. Lime sulphur is, perhaps, the more effective, and as the spray gives good control of powdery mildew this treatment is frequently preferred. Although a lime sulphur spray can be used at a concentration of 1 in 35 during winter and early spring, weaker solutions will be necessary in warmer weather if injury to the plant is to be avoided. For large-scale work, particularly in hilly country, the sulphur dust is more easily applied, and where mite control is the main objective reasonably good results are achieved. No matter which treatment be adopted, thoroughness in application is essential, and particular attention should

* *Tetranychus telarius* L.

be paid to the under surface of the leaves, where the pest is most numerous. If the mites are plentiful, some may survive a single spray or dust application. More than one treatment may then be necessary to give adequate control.

PAPAW BUGS.

A number of bugs are partial to the papaw, the two chief being the fruit-spotting bug* and the green vegetable bug.† The former is the more spectacular in its effects; the latter is more commonly encountered.

The fruit-spotting bug (the common name describes typical injury in banana fruits) is most troublesome in the Central district, where it achieved notoriety some years ago as a pest of bananas. The injury to papaws is seldom acute elsewhere. The actual damage caused by a comparatively small fruit-spotting bug population is sometimes considerable. The young growing point is attacked and cracks appear in both the leaf stalks and the main stem; fruit may develop black sunken spots where they have been pierced, and there is frequently a characteristic after-effect in which the young growth is stunted and crinkled. The check to the plant may be serious, particularly if growing conditions do not favour a rapid recovery.

The green vegetable bug attacks numerous hosts other than the papaw, for which it shows no special preference. The pest is frequently abundant in summer, and papaws may suffer, both the young growth and the fruits being attacked. In the latter case, a lesion appears where the fruit has been pierced, and produces a "marbled" appearance, which is reflected in the uneven texture of the edible flesh. As in the case of the fruit-spotting bug, an attack on the terminal growth produces distinct though noticeably less serious abnormalities.

Control of these pests by insecticides has not, as yet, proved practicable, and the grower must, when necessary, resort to handpicking.

THE YELLOW PEACH MOTH.

Growers are more familiar with the damage caused by the yellow peach moth‡ than with the insect itself. Papaws frequently suffer at least some dieback due to larval infestation at the growing point. Not all dieback is attributable to the pest, but when conditions are otherwise favourable for the plant and dieback still occurs, this pest can be suspected. The larvæ may also infest the fruit, penetrating the flesh particularly where adjacent fruits are in contact with each other. A similar type of injury to peach and citrus fruits is not uncommon in some districts.

The adult moths possess a wing span of approximately one inch, and the wings are yellow or orange with numerous black spots. Eggs are laid singly, and the larvæ when hatched soon commence to burrow into the fruit or growing point, as the case may be. When full fed, the larvæ pupate in a loose webbing among dry fragmented leaves or similar organic matter.

The habits of the insect are such that no control measures can be relied on to ease the position in the papaw grove. In the event of dieback from yellow peach moth, the grower has no option but to foster one

* *Amblypelta lutescens* Dist.

† *Nezara viridula* L.

‡ *Dichocrocis punctiferalis* Gn.

or more of the lateral shoots which develop, treating these as the bearing arms of the plant. In practice, it is advisable to cut off the damaged head from the plant and place a suitably sized tin over the cut surface to protect the stump from excessive decay.

NEMATODES.

The papaw is particularly susceptible to eelworm or nematode* attacks. The symptoms correspond with those in other hosts (Plate 228; figs. 2 and 3), and typically consist of malformed swollen roots—hence the colloquial term "knotty root." Although heavily infested the roots may still function to some extent, but the cumulative effect of an attack extending over many months, or even years, is such that the plant is starved for essential nutrients. Above ground the effect is apparent in the sluggish development of new spring growth, a lack of colour in the leaves, and undersized slowly maturing fruit. Ultimately the plant ceases to be profitable to the farmer.

Nematodes appear to thrive in the lighter types of soil, and as many papaw groves are located on precisely this kind of soil, nematode-free plants are the exception rather than the rule.

Nematodes are very minute eelworms which attack a large range of cultivated plants. The reproduction rate of this pest is very high. When the young hatch from the eggs (Plate 228; fig. 5) they move through the soil until they find the roots of a suitable host plant, which are then entered through incisions made by the needle-shaped mouth parts. Growth occurs within the the plant tissues, and "knots" or galls develop in the roots. When these galls are cut the small glassy pear-shaped female (Plate 228; fig. 7) can sometimes be seen embedded in the tissue. Several generations are possible in a year, and the build-up in the nematode population in soil carrying a suitable host is very rapid.

Control presents serious difficulties, and reasonable protection is the most that can be expected in practice. Natural movement of the eelworm through the soil is comparatively slow, and when high populations occur in relatively new land it is reasonable to suppose that the pest has been introduced with nursery stock or by dirty implements used previously in infested soil. It is therefore sound practice to clean the soil from implements which are being transferred to the papaw grove from infested truck crop areas. For the same reason, it is preferable to grow the seedlings in the grove rather than in an infested nursery from which they must later be transplanted. Alternatively, seedlings may be grown in ground which has not previously grown plants susceptible to nematode attack.

Although most crops are attacked, there are a few immune, or at least resistant, crops, which include many grasses, some cereals—e.g., wheat, barley, maize—and several varieties of cowpea. The use of such crops in conjunction with fallowing is very helpful in conditioning nematode infested land for papaws. A year or two's preparation in this way is by no means a waste of money; the crops themselves are of some value, and, most important of all, the papaws, when planted, get a good start, and may then crop profitably for a reasonable period in spite of nematodes.

For the same reason, papaws should never follow other nematode-susceptible crops, such as tomatoes and potatoes, in the rotation. If soil-conditioning is not practicable, the grove should be established on new ground or, failing this, the least infested ground on the property.

* *Heterodera marioni* Goodey.

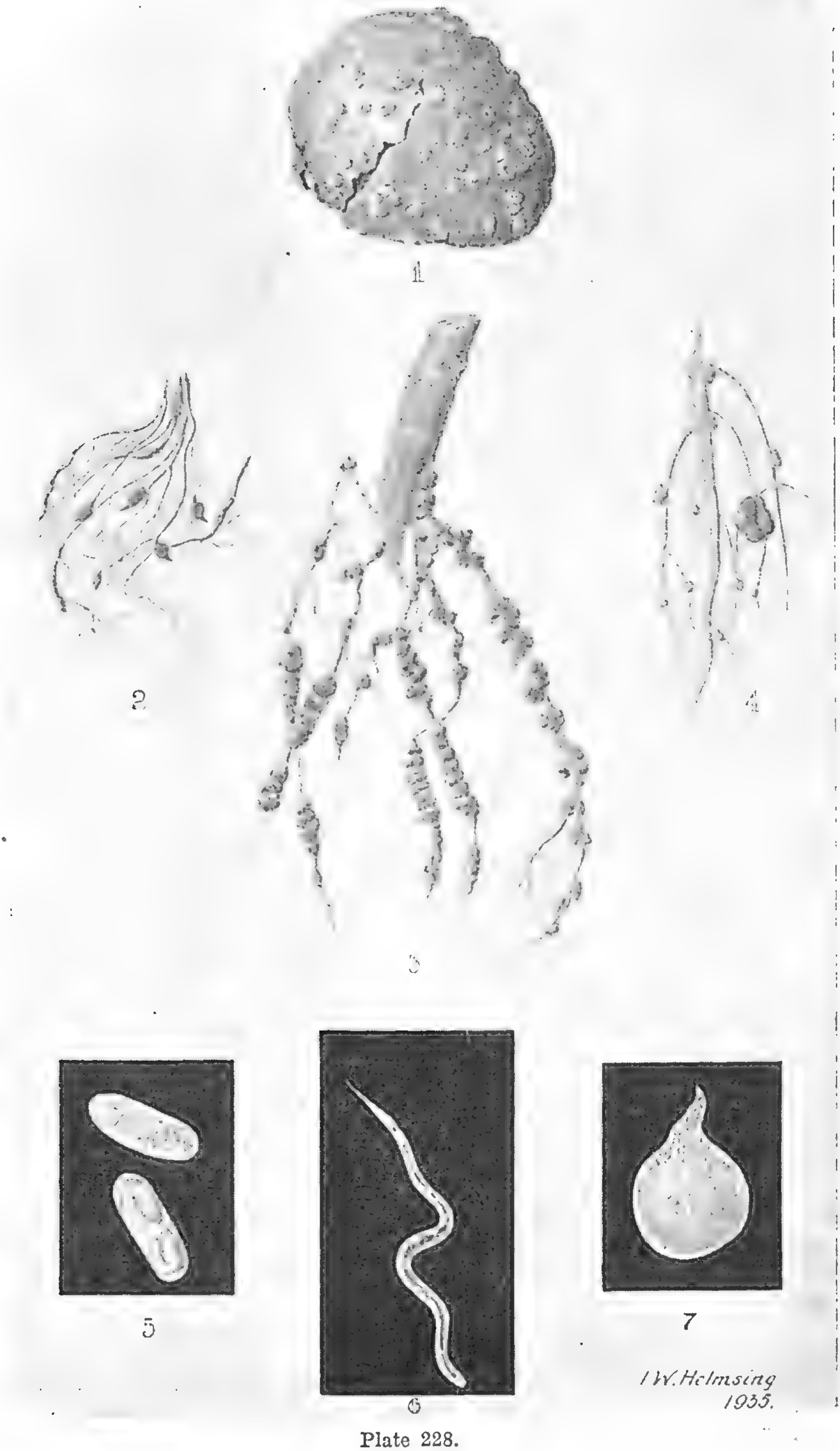

Plate 228.

Papaw failure due to nematodes is primarily a sequel to direct starvation following root injury, the vigour of the plant being proportional to its feeding capabilities. Liberal cultural and manurial treatment increase the efficiency of existing roots, while the plant tends, under such treatment, to throw out further lateral roots above the already injured tissues. The bearing life of the plant may be prolonged for a year or so in this way.

Careful attention to the isolation of the grove from outside contamination, conditioning the land with immune or resistant crops before planting, the selection of new ground when practicable, and adequate cultural and manurial treatment should therefore ensure a reasonably long bearing period.

OTHER PESTS.

Other pests of the papaw which may attract the grower's notice are fruit flies, fruit-sucking moths, and jassids.

Although authentic cases of papaw infestation by the Queensland fruit fly* are known, there is frequently some confusion in the grower's mind between this pest and scavenging species associated with fungal rots on the fruit. When the papaw is attacked by fruit fly, the injury is much the same as that in other commercial fruits, the edible flesh being destroyed by larvæ developing from eggs laid by the female in the fruit. Control measures are rarely necessary, but presumably the standard recommendations for this pest requiring the destruction of infested fruit and systematic luring with a vanilla-ammonia solution would diminish the losses.

Fruit-sucking moths† are primarily seasonal, and attack a variety of maturing fruits during summer and autumn. A number of species are usually associated with any one outbreak, and the fruit losses are sometimes considerable. Control recommendations in other countries require the use of poison baits, but these have so far proved valueless here. Reasonable protection can be obtained by inspecting the plants at night by means of a torch. The moths are then feeding, and can be easily caught by hand and destroyed. Systematic attention may be necessary for some weeks, but the work is well worth while when a maturing crop is at stake.

Jassids‡ are small agile hoppers which occasionally attack papaws in some parts of the State. When numerous they seriously affect the vitality of the plant, for partial or complete leaf failure may reduce the capacity of the plant to bear and mature good fruit. Adequate control measures are not available. Nicotine dusts certainly kill some of the immature stages, but the necessary expenditure is seldom justified in practice.

* *Chætodacus tryoni* Frogg.

† *Othreis fullonica* L. and *Eumænas salaminia* F. principally.

‡ Jassidæ.

DESCRIPTION OF PLATE 228.

Root Knot Nematode.—Fig. 1—Nematode-infested potato tuber. Fig. 2—Nematode galls on strawberry roots. Fig. 3—Nematode galls on tomato roots. Fig. 4—Bacterial nodules on lupin roots. Fig. 5—Nematode eggs x 150. Fig. 6—Larval nematode x 150. Fig. 7—Adult female nematode x 30. Figs. 1 to 4 half natural size.

Tobacco Seedling Production in North Queensland.

R. C. CANNON B.Sc.Agr., Instructor in Agriculture.

IT is generally recognised that the production of healthy, vigorous seedlings is of paramount importance to the tobacco grower. Given satisfactory growing conditions, such seedlings will make good growth and result in an even stand of uniformly maturing tobacco in the field. Such plants are also better fitted than weakly seedlings to withstand adverse weather conditions and the ravages of the numerous pests and diseases to which the crop is subject.

Selection of Site.

The land selected for the seedbeds should be well drained and protected as much as possible from strong winds, which dry out the soil and are prone to damage the protective coverings of the beds. The seedbeds should not be located, however, in low-lying, cold, or shady situations conducive to disease development. Loamy soils are admirably suited to seedling production, though in most cases the grower is forced to make use of a more sandy type of soil. The texture of the soil may be improved by ploughing under green manures or by the addition of suitable organic matter from other sources. All other considerations apart, it is most desirable that the seedbed area should be located conveniently with respect to the water supply. The regular attention required also demands that it be situated as close as practicable to the dwelling. It is inadvisable to attempt to grow seedlings continuously on the one area of land on account of the possible accumulation of spores of disease organisms. For preference, a system of seedbed rotation should be evolved to overcome this difficulty.

Area Required.

The extent of the seedbeds required will be governed by the area it is proposed to plant in the field; it is usual to regard 100 square feet as adequate to plant out 1 acre. Old seedlings cannot be expected to make the same growth in the field as young ones, and in order to obtain a good stand in the field it is essential that the seedlings be young and vigorous. As it is impossible to accurately forecast weather conditions, it will be obvious that the objective can only be attained by laying down a series of beds at regular intervals to provide suitable seedlings for planting when appropriate weather conditions are experienced. This means a larger seedbed area, with slightly increased costs, but the added security provided would to a large extent offset the additional costs.

Preparation of Beds.

With such minute seed as that of tobacco, it is essential to have a bed of very fine tilth, and the need for thorough cultivation cannot be stressed too much. The land should receive several cultivations before being made up into beds.

The next operation is the sterilization of the soil, which serves a dual purpose—namely, the destruction of harmful organisms in the soil as well as weed and grass seeds. The cheapest and most general sterilizing agent is heat; for this purpose brushwood or the organic material from certain antbeds may be used. Very good results have been obtained with

the latter, which is easy to collect and handle, and produces a steady, even heat. The whole area of the seedbeds, inclusive of pathways, should be covered; in the case of wood, a layer about 9 inches deep should be used, or where antbed is employed a layer 3 to 4 inches thick should be sufficient. Following the burn, all unburnt fragments should be carefully raked off before the whole bed is dug over to thoroughly incorporate the residual ash. At this stage it will be found convenient to erect the framework, the design of which will be determined by the methods to be adopted as a protection against diseases and pests.

Framework.

In the hot, dry climate of the tobacco-growing areas of North Queensland, unprotected seedbeds rapidly dry out, and the young seedlings are liable to be scorched by the direct rays of the sun. Therefore, it is necessary to make provision for the shading of the young seedlings during the day, and also to protect them from the inroads of insects. A suitable framework will not only maintain the beds in good shape, but will also provide a base for the erection of covers. For this purpose the most satisfactory material is sawn timber, which is easy to erect and gives a neat finish which assists in making the beds moth-proof. Many attempts have been made to utilise cheaper materials, but none are quite as effective as sawn timber, which will last well if treated with care. Boards 6 inches wide are well suited for the sides of the seedbeds.

The maximum length of the seedbed for ease of manipulation is about 50 feet, while the width will be determined by that of the covering material to be used, the usual width of beds being from 3 to 4 feet. The most convenient framework has three straining posts at each end to carry the wires which support the covers. The centre post should be high enough to hold a central wire about 15 inches above the ground. The side posts need not be so long, and are placed a few inches in from the edges to carry wires about 9 inches above the level of the bed.

Final Preparation and Fertilization.

As a rule, tobacco seedbeds are of necessity situated on poor, sandy soils deficient in organic matter If possible, the humus content of these soils should be increased by the application of horse or goat manure or some other suitable organic matter used in moderation. This should be previously sterilized by boiling to destroy any harmful organisms which may be present, as well as the weed seeds, which are inevitable. Where such organic matter is added, the application should be made at least two weeks prior to the sowing of the seed. A dressing of such organic manures will improve the texture of the soil, as well as its capacity for retaining moisture and plant foods. Plants grown in good textured soils are enabled to produce well-developed root systems, which materially assist in their establishment in the field.

The general practice is to apply a dressing of an ordinary fertilizer mixture, such as 4: 12: 6, before sowing the seed. An alternative procedure is to apply superphosphate at the rate of 1 oz. per square yard and nitrate of soda at the rate of ½ oz. per square yard. It is not considered necessary to include potash in this mixture, since sufficient potash is added to the soil in wood ashes when the beds are sterilised by burning. The superphosphate and nitrate of soda may be applied separately or else thoroughly mixed just before application. In all cases the fertilizers should be thoroughly incorporated in the soil at least one week prior to sowing. While the beds are still in the rough, it may

be of advantage to apply sufficient water to ensure a good moisture content in the soil. It is most important that the soil be well dug and raked over to break down any coarse soil particles before proceeding to sow the seed.

If desired, as an added precaution against damping-off, the beds may be watered over with Cheshunt mixture a day or so before planting. The preparation and method of application of Cheshunt mixture is described at the end of this article.

Sowing the Seed.

The seed should not be sown too thickly, otherwise soft, spindly plants are likely to result. It has been found that a rate of two-thirds of a teaspoonful of seed per 100 square feet of bed is ample for the purpose. The usual method adopted for sowing tobacco seed is to mix it with fine sand or ashes, and then distribute the mixture as evenly as possible over the surface of the bed by hand or by means of a home-made shaker. This should be done at a time when there is no wind, otherwise the distribution will not be even. Another method is to apply the seed in water through an ordinary watering-can—a method which has the advantage of being more or less unaffected by windy conditions. A can is half-filled with water, and the requisite quantity of seed added and well stirred before the rest of the water is added to nearly fill the can. The seed will remain in suspension for some time, but the can should not be allowed to stand for any length of time without being again stirred before sowing. Some growers favour the addition of a fine layer of loamy soil to cover the seed, but it must be remembered that the seed should not be deeply covered. As soon as convenient, the soil should be tamped down with a flat board to establish contact between the seed and the soil particles. In many districts it has been found necessary to apply a light mulch of medium grade river sand $\frac{1}{8}$ inch in thickness to protect the seed from the ravages of seed-harvesting ants. In any case, this mulch possesses the added advantage of appreciably reducing the evaporation of moisture, and is to be recommeded irrespective of the prevalence of ants. Should leaf-cutting ants make their appearance, they can be dealt with by broadcasting fine maizemeal over the seedbeds when the seed is germinating.

Covering of Beds.

As protection against the sun and insects, a number of materials have been used—e.g., hessian, stockinette, cheese-cloth, Rhodesian cloth, duck, and calico. When using hessian care must be taken to ensure that the plants receive sufficient sun, otherwise soft seedlings are apt to result. A very effective cover may be made from Rhodesian cloth, which is a specially reinforced cheese-cloth. It has the advantage of permitting the entry of abundant light and air, both of which are so necessary to the growth of good, hardy seedlings. Covers of Rhodesian cloth can be kept in position from 5 p.m. to 10 a.m. without adversely affecting the seedlings, and if retained in position during these hours they will prevent the moths of the stem borer and leaf miner, which do not fly by day, from gaining access to the seedlings for egg-laying purposes. Recently the use of benzol vapour against blue mould has come into prominence, and this calls for materials of better quality, which must be more or less gastight. When suitable calico or duck covers are used in conjunction with benzol vapour, they must be removed early in the day, so that the plants may receive the benefit of the early morning sun. Even so, leaf miner and stem borer infestation may be somewhat reduced by the

presence of these covers. Whatever covering material is chosen, it still remains necessary to harden off the seedlings a week or so before planting out.

As mentioned previously, it is usual to have three wires running the length of the beds to support the covers. Quite a number of methods are employed to attach the covers so as to facilitate removal for watering, spraying, and sunning, but space will not permit of detailed descriptions.

Care of the Beds.

The vital stage in seedling production occurs during the early period of growth, when the plants are small and possess a poorly developed root system. At this stage the beds should never be allowed to dry out, and abundant, though not excessive, water should be supplied. The amount required and the frequency of waterings will depend on weather conditions; under dry conditions it may be necessary to water as often as three times a day during the first few weeks. As the plants grow, and the root system extends, watering may be reduced to once daily. From the time of germination onwards it is necessary to protect the young seedlings with the covers at least during the hot periods of the day.

Seedlings should always maintain a vigorous growth, and should there appear to be any serious retardation of growth at any time, the application of a solution of nitrate of soda in water at the rate of ½ to 1 oz. per 4 gallons of water will in most instances sufficiently accelerate growth. On the other hand, it is inadvisable to apply nitrogenous manures too liberally, or there is likely to be a tendency towards soft seedlings, which will be difficult to harden off.

Hardening off should be a gradual, rather than a sudden, process, and the plants should be allowed an increasing amount of sunlight in the mornings and afternoons until they can stand the full sun during the whole day without serious wilting. The tendency of some growers to overdo this and seriously retard growth is to be deplored. It is much preferable to have another series of beds in case planting is delayed. Vigorous, hardened seedlings are able to make a rapid recovery from the shock of transplantation and to make quick growth in the field.

Protection Against Diseases.

One of the most serious diseases encountered in tobacco seedbeds is blue mould, in the development of which, over-watering of beds is often a predisposing factor. In the past good results have been obtained in North Queensland with a colloidal copper spray. Gas treatment has proved most effective during the past two seasons, though the costs are much higher. Colloidal copper also offers protection against frog-eye leafspot, whereas benzol apparently does not, and if the latter is used it is strongly recommended that the seedlings be sprayed at least once a week with the colloidal copper spray in addition. This spray will also afford some measure of protection against infestation by the leaf miner and stem borer.

Satisfactory results may usually be obtained by regular spraying with colloidal copper twice a week. The object is to maintain a thin protective film on the under-surface of the leaves, and where the plants are making very rapid growth, or where there is a likelihood of the spray having been washed off by rain, it may be necessary to increase the frequency of treatment. It is most essential that the under-surface of

the leaves be well covered, otherwise the spray will be ineffective. When the plants are very small a fine spray over the whole area will be adequate, but as soon as they are large enough to stand greater force a flat spray should be used. The beds should be sprayed from both sides with the rod held nearly horizontal so as to turn back the leaves and ensure complete covering. Very satisfactory results have been obtained with a bucket-pump and spray.

Home-made colloidal copper spray may be prepared as follows:—Dissolve 1 lb. of bluestone fines in 2 quarts of water in a non-metallic vessel, then stir in 1 pint of molasses, and make the solution slightly alkaline by the addition of caustic soda solution. For this purpose 5 oz. of caustic soda are dissolved in 1 quart of water, and gradually added to the bluestone and molasses mixture with constant stirring. Sufficient of this solution must be added so that litmus paper will not be affected—i.e., red paper does not turn blue nor blue paper red. Usually the mixture will thicken just before this point is reached. For spraying, this stock solution is diluted as follows:—

(i.) Stock solution, 1 quart in 7 gallons of water; to this add
(ii.) Potash soft soap, 6 oz. dissolved in ½ gallon of water.

These quantities will make up about 8 gallons of spray. It will be found convenient to make up as large a quantity of the stock solution as can be stored, since it will not deteriorate with storage, but rather improve. On the other hand, it is inadvisable to keep the stock solution over from one season to the next.

Gas treatment with benzol has proved more effective in controlling blue mould in seedbeds than colloidal copper, and was used on a commercial scale during the past season. The initial experiments carried out in the Southern States indicated a higher concentration of vapour than has been found necessary in North Queensland, where an evaporating surface of 1 square inch per square foot of seedbed has been found to be ample. The first essential is to have the beds as nearly gastight as possible, a condition which is fulfilled by good quality calico or duck without any further treatment. It is advisable, however, to protect the material from the growth of moulds, which darken it and reduce its effective life. For this purpose alum-lead acetate has proved satisfactory, and its preparation and use is outlined hereunder:—

Dissolve 1 lb. of alum in 1 gallon of boiling water with stirring, then add this to 4 gallons of cold water. Soak the cloth in this solution for twenty-four hours, and make sure that it is thoroughly wetted throughout. Then wring lightly before transferring to a solution prepared by dissolving ½ lb. of lead acetate in 1 gallon of boiling water with stirring, to which is subsequently added 4 gallons of cold water. Soak the material in this solution for five or six hours, and then wring out and allow to dry.

A proprietary product kown as Shirlan AG also has been found satisfactory for this purpose, and has the advantage of being easily prepared. A suspension is made up by stirring ½ lb. in 5 gallons of water, and the cloth is immersed in it, and kneaded well, for half an hour.

To prevent leakage of vapour from the beds the edges should have a neat, smooth finish, and ends should be made of timber. It has been found quite convenient to use the usual tent-shaped beds for benzol treatment. The benzol is exposed in shallow tins about 4 inches square

and about $1\frac{1}{4}$ inches deep. These tins should not rest on the ground, but can be placed on suitable short stands made of wood or wire. There should be sufficient of these to provide 1 square inch of evaporating surface to every square foot of bed, and they should be evenly spaced along the length of the bed. The benzol is exposed in these tins during the night from, say, 5 p.m. or 6 p.m. to 7 a.m. Experiments carried out in the Dimbulah district during the past season showed the consumption of benzol to be about 2 fluid oz. per 100 square feet per hour—that is, a little over $1\frac{1}{4}$ pint per 100 square feet per night. Any benzol remaining in the tins when the beds are opened in the morning should be collected and stored for future use. The beds should be opened to allow free passage of air, which will remove any vapour and so prevent damage to the seedlings when the sun is hot.

As previously mentioned, it is advisable to spray in addition such seedlings at least once a week as a protection against frog-eye leafspot as well as leaf miner and stem borer.

Should damping-off develop at any time, prompt application of Cheshunt mixture will usually check its spread. To prepare this mixture grind up some copper sulphate (bluestone) and some ammonium carbonate (rock ammonia) separately, and then thoroughly mix them in the proportions of two parts of copper sulphate to eleven of ammonium carbonate, and store in a well-stoppered bottle at least twenty-four hours before using. The powder is dissolved in water at the rate of 1 oz. per 2 gallons of water, and the solution is then applied with a watering can, which should be well rinsed after use to prevent corrosion.

At all times the beds should be carefully observed in order that remedial measures may be instituted immediately any disease symptoms are apparent. Strict attention to seedbed sanitation will have the effect of greatly reducing the liability to losses from diseases and pests. Should webworms or leaf-eating caterpillars become numerous in the seedbeds in spite of the adoption of the measures recommended in the preceeding paragraphs, it will be necessary to dust the seedlings twice weekly with a 50 to 75 per cent. arsenate of lead dust to obtain control.

DESTRUCTION OF OLD TOBACCO PLANTS.

The practicability of checking the ravages of various pests and diseases will determine in a very large measure the degree of success achieved in growing tobacco. The leaf miner and stem borer constitute a very serious menace to the crop, and it is essential that the populations of these two insects carrying over from the old crop to the new one should be reduced to a minimum.

Much can be accomplished by the elimination of breeding grounds during the months intervening between successive crops of tobacco, because in some of the more important tobacco districts practically nothing but tobacco is grown. Hence, if tobacco plants are uprooted and destroyed by fire as soon as possible after the completion of the harvesting of the leaf, and if volunteer plants are similarly dealt with, the new crop should get a good start free from any serious infestation. The position will be improved still further if the destruction of these tobacco plants is accompanied by the elimination of several leaf miner weed host plants, which occur in the main tobacco districts, and are closely allied botanically to tobacco. Again, from the point of view of insect control, the production of two tobacco crops in twelve months is fraught with great danger, at least in so far as the incidence of leaf miner and stem borer is concerned, and should be avoided on that account.

The procedure just recommended, of course, will help materially to reduce the carry-over of tobacco diseases. Growers are advised not to burn old tobacco stalks on the site of a new seed-bed.

Inconspicuous Organisms which Aid the Growth of Plants.

H. E. YOUNG, M.Sc.Agr., Assistant Research Officer.

OF recent years the importance of various fungi which are found in association with the roots of plants has been realised, and a considerable amount of research into the nature of the relationship carried out. Different species of fungi are found with many different groups of plants. The first plants to receive attention were the orchids. In these it has been found that the seeds will not germinate naturally without the presence of a particular fungus.

In the case of the orchids, the fungus after germination enters the roots of the seedling and lives there in the root tissue, sending out fine threads to the exterior, where they come into contact with the bark or leaf mould, &c., on which the plant is growing. The fungus is able to break down the insoluble organic matter in the dead bark and leaves into compounds which are available to the plant. The plant then absorbs the greater proportion of its ration of these substances through the roots, and some probably finds its way along the threads into the plant cells where the plant, under normal circumstances, is continually digesting the fungus structure after it reaches certain stages of development. By these means the hitherto unavailable but essential foods in the raw organic matter are rendered usable for the orchid plant.

Of course, if the seed lodges where one of these fungi is not present, in the first place it will not germinate, and in the second place if it did certain forms of organic matter would be unavailable to the growing plant. The germination effect is brought about by the fungus causing a rise in the concentration of sugars and also adjusting the acidity of the substratum. Germination can now be caused in test tubes by artificially supplying these conditions without the presence of a fungus.

After the discovery of the importance of fungi to orchids other plants were examined for similar effects and it was found that nearly all plants growing on peat soils, such as the heaths, had these fungus associations. Following this, similar structures were found on the roots of many forest trees, particularly conifers, and the list of plants with these associations is growing rapidly.

The failure to grow pine trees successfully in many nurseries was then found to be due to the absence of the particular fungi which are normally associated with the pines, and vigorous growth was produced by inoculating the nursery soils with these fungi. This is easily done by getting a small quantity of soil from beneath a vigorously-growing tree and placing it, with its contained fungi, in the nursery beds. The trees then, instead of being small, yellow and stunted and gradually dying out, become green and grow vigorously. This was found to be the case in several nurseries in Queensland and has been found in numerous cases overseas and in other States. The Queensland native hoop pine could not be successfully reared in Nyassaland until the nursery soil was inoculated with material from beneath a vigorous hoop pine tree.

In the case of trees, the fungus is found on the roots in various types of structures (Plate 229) know as mycorhiza, the type appearing to depend on the soil conditions, the species of tree, and the species of

fungus. In soils which have a low content of raw organic matter the fungi come to act as parasites, when the structures are called pseudo-mycorhiza. This is in direct contrast to the assistance they render when the supply is adequate.

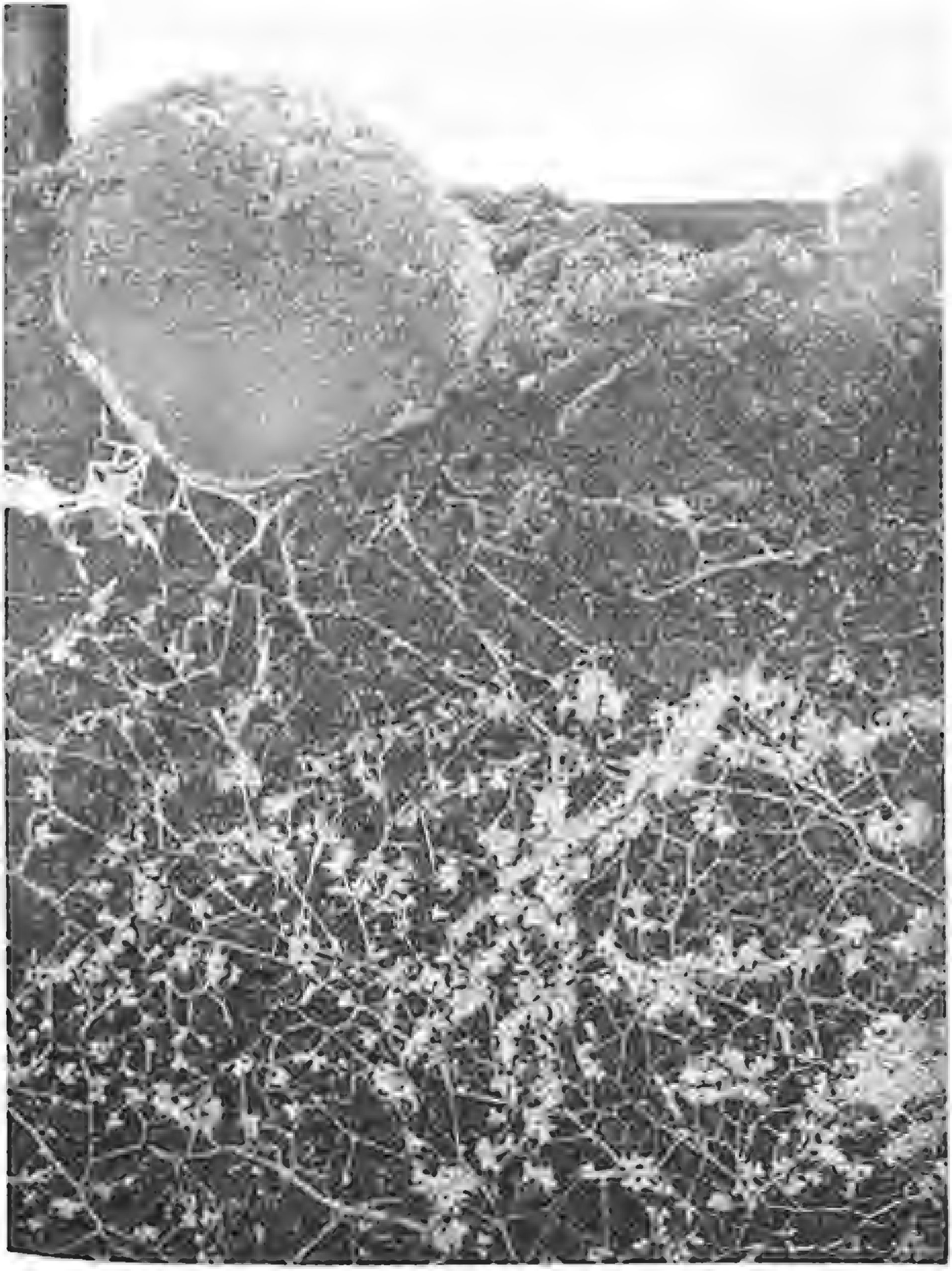

Plate 229.

Mycorhiza and fungus fruiting body on roots of a pine tree.

In the normal beneficent type, the fungus threads branch out from the mycorhiza, which are situated on the feeding roots in the surface layers of the soil, and penetrate the soil in all directions and appear to represent a very much extended root hair system. They spread much

further and come into contact with many more soil particles than do root hairs, which disappear from fungus-infected roots. These fungi in the soil act in the same manner as do those in association with orchids. They make available the products of raw organic matter in the soil which the plant is unable to use before the fungus action, and without which poor growth is usually produced. The fungi probably have a second role in the soil by carrying mineral salts in a dissolved state along the fungal threads to the roots.

Poor growth in a soil does not necessarily mean that the fungus is absent, but may indicate that a sufficient supply of raw organic matter is not present and should be supplied for the fungus to work on. In fact, one worker in England has shown that with forest trees one can tell the state of the organic supply of the soil by microscopic examination of the mycorhiza on the root of the plant growing in it when once the normal structure for that species has been found for comparison. There have been cases reported also of harmful fungi forming pseudo-mycorhiza with roots and causing poor growth in plants.

Mycorhiza have been reported as being present on citrus and have been observed on the few trees examined in Queensland. Members of the Pasteur Institute have carried out researches on citrus mycorhiza in California, and from their work, and that of others, it would appear likely that poor or contradictory results obtained after the application of fertilizers to citrus trees may be explained by taking mycorhiza into consideration. Ample supplies of all the essential mineral salts are, probably, in the case of mycorhizal trees, of little value without the presence of sufficient raw organic matter for the mycorhizal fungi to work on; consequently, mulching might be of value in these cases.

In the case of a disease in pecan trees known as pecan rosette, it has been found that the treatment of affected trees with zinc alleviates the trouble. One investigator of this problem considers that the presence of zinc is essential in the pecan tree in order that it may maintain a correct balance with its mycorhizal fungus. The fungus, according to this theory, apparently becomes antagonistic towards the tree when there is an insufficient supply of available zinc. It has also been suggested that mottle leaf of citrus may be due to the same cause.

Mycorhiza have been reported from strawberries and many species of fruit trees and grasses. Australia's eucalypts, even, possess mycorhiza. Work is being carried out in France on the mycorhiza of the potato, and from reports it appears likely that the results will be of considerable economic value. Research on mycorhizal problems is really only beginning, and exacting work will have to be done with the various plants before the complete picture of the fungus-plant association is made clear. Experiments in the study of the physiology and nutrition of the fungus will have to be done, and research concerning the effect of different fungus species on the nutrition of particular plants will have to be carried out. So far, the study of the mycorhiza of forest trees is, in general, in advance of that of other crop plants, but if the results at present being obtained experimentally with species of pine, particularly in England, are any criterion of what may happen with other plants, some important results are likely to be obtained from a closer study of this little-known problem.

Sown Pastures and Their Management.

C. W. WINDERS, B.Sc.Agr., Assistant Research Officer.

(PART V.)

[*Continued from p. 429, Part 4, Vol. XLVIII.—October, 1937.*]

SELF-REGENERATING SUMMER PASTURE LEGUMES.

Lespedeza (*Lespedeza striata* Hook. et Arn.).

Origin and Distribution.—The common lespedeza is a native of the Orient which has been cultivated for many years in the Southern United States of America for hay, pasturage and soil improvement purposes. It was introduced to Queensland over thirty years ago and has spread to some extent in the coastal strip south of Gympie. No systematic use of the legume has yet been made in Queensland, but there would appear to be a future for it if properly utilised.

Description.—Lespedeza is a somewhat bushy plant reaching a height of about 18 inches when growing under favourable conditions. The branches in the lower portion of the plant are almost horizontal and individual plants may be as much as 3 feet in diameter. Small leaves are borne in profusion along the stems and are distinctly veined. The small rose-coloured flowers occur singly in the axils of the leaves in all parts of the plant.

Climatic Requirements.—Common lespedeza is a summer-growing annual which makes its development between October and March and goes to seed prior to dying off in April. Because of its long growing season it is of more use in the sub-tropics than in temperate areas, and for the same reason might be expected to have a limited sphere of usefulness in areas in which the wet season commences late in the summer. The plant is moderately susceptible to frost injury and late frosts may kill early-planted lots and destroy late sowings before seed is set.

Soils.—An important feature of lespedeza is its ability to thrive on soils too acid to permit of the development of the common clovers (white, red, &c.) and lucerne. Since most of our coastal dairying and grazing country is somewhat acid in nature this is an important characteristic. On the most sour soils liming would be necessary. The range of soil types on which lespedeza can be grown is large, and one of its main uses is for the improvement of poor, worn soils.

Planting.—Lespedeza is used both for pasture and for hay, and seeding practices vary accordingly. For pasture purposes, the legume can be sown alone, in admixture with other pasture seeds or on already established pastures. When sown alone on well-prepared land about 15 lb. of seed per acre should produce a good stand. Sown with paspalum or Rhodes grass seed, 4 lb. per acre would suffice to start the legume. Broadcasting 4 lb. per acre on ploughed or disced native pasture or paspalum pasture would ensure a good foundation for the spread of the plant. Quite commonly in the United States, lespedeza is broadcasted in the early spring on top of crops of wheat, oats or other cereals and slightly covered by harrowing. Spring or early summer sowing is desirable.

Management.—Since lespedeza is an annual which regenerates itself each year from self-sown seed that germinates in the spring, the early summer grazing of pastures containing this legume must not be heavy,

otherwise the seedlings might be destroyed. Once the plants have become established, the pastures may be grazed heavily at intervals, but towards the end of the season the legume must be permitted to ripen seed, if it is to carry itself on and spread. The use of superphosphate may prove beneficial to the plant.

Conservation.—Lespedeza is said to make a good class of hay, but, so far as is known, it is not yet used for this purpose in Australia. The common form is not of tall enough growth to make a good hay plant, but the selection known as Tennessee 76 is used for hay in United States of America.

Feeding Value.—The plant is palatable and of high nutritive value if eaten before it becomes too stemmy. All classes of stock are fond of the green plant and of its hay.

Seed Production.—The usual method employed in Queensland is to pull the maturing plants up, allow them to dry out on a floor, and shake or beat the seed out. In the United States, where seed production is of some importance, harvesting is carried out by a mower with a seed pan attached to the back of the cutter bar, or else the crop is cut and raked while the dew is on it, and run through a grain thresher when dry.

Special Uses.—Lespedeza is used fairly extensively in the South-eastern United States for soil improvement purposes, either in crop rotations or on worn-out cultivation areas, and may prove useful for this purpose in Queensland.

Korean Lespedeza (*Lespedeza stipulacea* Maxim.).

Origin and Distribution.—Like the common lespedeza, Korean lespedeza is a native of the Orient and is cultivated most commonly in the United States, particularly in the warm temperate States, north of the sub-tropical Gulf States. The legume has been tried in Australia, but in Queensland at least appears to be of less general promise than the common lespedeza.

Description.—Korean lespedeza is annual in habit and is a summer grower. The leaves are broader than those of common lespedeza and the plant is generally larger and coarser. The seeds are borne in the axils of the leaves on the ends of the branches.

Climate Requirements.—In the United States, Korean lespedeza can be used in areas experiencing a fairly protracted winter, because the seed germinates at a moderately low temperature, and the plant matures early and so sets seed before the onset of frosts.

Soils.—Practically any type of soil is said to suit this legume.

Planting.—Korean lespedeza is utilised similarly to the common lespedeza and should be planted as indicated for *Lespedeza striata.*

Management, Conservation and Feeding Value.—The remarks made under these headings in the section dealing with common lespedeza apply also to Korean lespedeza.

Townsville Lucerne (*Stylosanthes sundaica* Taub.).

Origin and Distribution.—Townsville lucerne is a native of Brazil and other tropical American countries and now has a wide natural distribution as a weed in warm countries. It has been naturalised in

Queensland for many years and within the past 20 years has been spread both naturally and by artificial means over a lengthy strip of coastal country in North Queensland.

Description.—Of annual habit, Townsville lucerne (Plate 230) is a shrubby plant with numerous branches each up to 3 feet or so in length and clothed in a greyish down. The branches are often prostrate, but erect branches up to 2 feet high are produced. The leaflets occur in threes on short stalks. The flowers are small and occur in dense rounded heads at the ends of the stems. The "seed" is small, angular and grooved across the middle and has a stiff hooked bristle at one end.

Plate 230.
Townsville lucerne.

Climatic Requirements.—Townsville lucerne is a summer-growing legume which germinates following spring or early summer rains and matures prior to the following winter. Since the plant depends for its regeneration on self-sown seed, it is only in areas with a long summer that Townsville lucerne is of permanent value. Though it will survive fairly long, dry periods, it will only develop properly under fairly high rainfall conditions. Little success has been attained south of Rockhampton or outside tropical areas with an annual average rainfall of about 40 inches or more.

Soils.—Provided moisture conditions are satisfactory, Townsville lucerne will thrive on a variety of soil types, from cultivated scrub soils to poor forest soils. Apparently it can tolerate a high degree of soil acidity, but a well-drained soil is desirable.

Planting.—The plant is propagated by means of seed, which is fairly plentifully produced in the main growing areas. What is commonly considered as the seed is really a hard pod containing the seed. Unless their surface is scratched to permit of easier uptake of moisture by the seed, the pods are likely to lie in the ground for some time before germination occurs.

The chief use of Townsville lucerne is as a constituent of permanent pastures, either native or artificial, and it is commonly sown down on established pastures. Where practicable, it is desirable that a form of seed-bed be provided by discing or peg-harrowing of the pasture, followed by a brush-harrowing to cover the seed. The best time to plant is with the advent of the summer wet season, though earlier planting is advisable if spring rains occur. In order to get the legume started on a property, scattered small areas might be sown at the rate of 1-2 lb. of seed per acre. These areas would serve as distribution centres, since the seed is readily spread in manure, on the hair of animals, &c.

Management.—Townsville lucerne is less likely to bloat ruminants than are lucerne and the common clovers, but where the plant is plentiful, bloating must be guarded against. Intermittent grazing should be practised and seeding must be permitted.

Conservation.—Neither hay nor silage are as yet made from Townsville lucerne.

Feeding Value.—The rank growth produced by the plant at the height of the rainy season is apparently not relished by stock, but as the plant commences to dry out from March onwards, stock readily eat it. Since the plant is late in maturing, the dry autumn encourages self-haying and the dry material, even when it has shattered, is greedily eaten. This autumn feed is particularly valuable. The nutritive value of Townsville lucerne is high, though the dry, stemmy material is much poorer than lucerne.

Special Uses.—Whilst at present Townsville lucerne is used mainly for pasturage, it is possible that it might have some value for soil renovation purposes, since it can be grown on fairly poor soils.

Undesirable Features.—In some countries the plant has a tendency to spread on to cultivated land and to behave there as a weed. To date there is no indication that the plant will become a pest of any consequence in Queensland.

ANNUAL SUMMER-GROWING PASTURE GRASSES AND FODDER CROPS.

* Sudan Grass (*Sorghum sudanense* Stapf).

Origin and Distribution.—Sudan grass is a native of tropical North Africa, now extensively used in most subtropical and tropical agricultural areas as a summer pasture plant. In Queensland it is perhaps the most commonly used annual summer pasture.

Description.—Normally, Sudan grass is annual in habit, though it may last for two or three years on occasions. It is a tufted plant which stools freely, the stems reaching a height of up to 10 feet. The thickness of the stems is very variable, but is seldom greater than $\frac{1}{8}$ inch. The

* A special leaflet dealing with Sudan grass is available on application to the Department of Agriculture and Stock.

length of the leaves also varies greatly, the length being up to 2 feet and the width $\frac{1}{2}$ to $\frac{3}{4}$ inch. The erect leafy stems eventually produce spreading flower heads. The root system is fibrous and there is no development of underground rootstocks such as characterise Johnson grass.

Climatic Requirements.—Sudan grass is a summer-growing annual, which is capable of developing on a lower rainfall than most other summer annuals. In Queensland it is grown without irrigation in the driest agricultural districts as well as in fairly wet districts. Early seedlings are easily killed by frost.

Soils.—Whilst it prefers rich loams, Sudan grass will produce a crop on a large number of soil types.

Planting.—A thoroughly prepared seedbed is as necessary for Sudan grass as for similar crops. Sowing should be carried out in spring or in early summer, a seeding rate of 5—15 lb. per acre being used. The quantity of seed used depends on the method of sowing and the district, lower rates being employed in dry districts and when the seed is drilled in. Occasionally Sudan grass is planted in rows about 3 feet apart, but more usually it is drilled close together or broadcast. Sudan grass seed is often contaminated with seeds of the noxious Johnson grass, and seed should always be purchased from a reliable source.

Plate 231.
Harvesting a crop of Sudan grass in Central Queensland.

Mixtures.—Because of its erect growth and good hay qualities Sudan grass is occasionally sown with cowpeas and the mixture ultimately used for hay or silage.

Management.—Sudan grass is used chiefly for hay and for grazing. If used for grazing in the immature stages, careful management must be practised to prevent losses of stock due to prussic-acid poisoning. Whilst the grass is commonly grazed at all stages of growth, frequent heavy losses are experienced. Once the plant has reached the flowering stage all danger of poisoning is passed. The plant may safely be fed after cutting and wilting, but wilted young growth prior to cutting is extremely dangerous.

The grass makes rapid recovery after grazing and several grazings are obtainable during the growing period.

Conservation.—For hay purposes, Sudan grass is a very suitable plant, since it is a heavy yielder in a short time, cures readily and makes a good class of hay. The earlier cuttings should be made when the crop is commencing to flower and the last cut when the grass is in full bloom. Three or four cuttings may be expected during a season.

Sudan grass is an excellent silage crop, either stacked or chaffed.

Feeding Value.—Stock readily eat Sudan grass in all stages of growth and as hay or silage. It is advisable to chaff stemmy growth before feeding. The feeding value of the grass is excellent, though it falls considerably as the plant matures.

* Sorghums (*Sorghum vulgare* Pers.).

Origin and Distribution.—The cultivated sorghums originated in northern Africa and the warm Asiatic countries and are now very extensively grown in all warm countries for green feed, silage and grain.

Plate 232. [*Photo. W. C. Miller.*

A young sorghum crop in the Central-West.

Description.—There are two main classes of sorghum grown in Queensland, namely the saccharine or sweet sorghums, grown for fodder purposes, and the grain sorghums, grown for their grain. There is a wide variety of types, but all are tufted, erect, stooling plants with fairly thick stems and long, broad leaves.

Climatic Requirements.—Sorghums can be grown without irrigation in all the agricultural districts of Queensland and they are the most suitable fodder and grain crop for dry districts.

Soils.—Whilst fertile soils produce the heaviest crops, good results are obtained with the sorghums on many soil types.

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* Special pamphlets dealing with sorghums are obtainable from the Department of Agriculture and Stock.

Planting.—Sorghums should be sown only on well-prepared land, and planting should be carried out during the spring or early summer. Since the crop is being grown for harvesting, it is advisable to sow in well-spaced drills, about 5 lb. of seed per acre being used.

Management.—Owing to the great danger of poisoning, saccharine sorghums should not be grazed by stock, but should be harvested before feeding. For fodder purposes, the best time to cut is when the grain is formed but still soft, but the nutritive value is retained in a large measure well after this stage is passed. The crop is usually cut in small sections with a cane knife, but is most readily harvested by a maize binder.

Conservation.—The saccharine sorghums make good silage and are commonly ensiled.

The grain sorghums are heavy yielders in most districts.

Feeding Value.—Saccharine sorghums are very palatable and nutritive if fed when chaffed and before too mature.

* Maize (*Zea mais* L.).

Origin and Distribution.—Maize is a native of subtropical America and is extensively grown in most warm countries, chiefly for grain, but also for green fodder and silage.

Climatic Requirements.—Maize is a summer-growing annual, which requires a moderate to fairly high rainfall, together with a fairly long growing season. It is somewhat drought resistant, but has not the same power of recovery from dry spells as has sorghum. It frosts fairly easily.

Soils.—Most good quality soils, provided they are well-drained, are satisfactory for maize.

Planting.—The seed should be planted only on well-prepared land. The time of planting depends on the district and the variety and extends from August to January. Sowing in drills is desirable, a seeding rate of about 10 lb. per acre being employed.

Management.—The green crop has its highest feeding value when in cob and the grain glazed, but is often cut before coming into ear in order to supply feed which is urgently required. The crop may be cut by hand with a cane-knife or harvested with a sledge-cutter (Plate 233), or the maize harvester.

Conservation.—For silage purposes maize should be cut when fairly green and succulent. The best time is when some of the ears are dented or glazed, a portion of the husks are dry and the upper leaves are still green. Older growth which has failed to mature its grain may be conserved as stover, the cut material being cured in the field. The grain is, of course, readily conserved, either in the crib or in tanks.

Feeding Value.—The feeding value of green maize, maize silage, maize stover and maize grain is fairly good, but maize and its products must be balanced with some protein concentrate to provide a production ration.

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* A special pamphlet on Maize Cultivation is available from the Department of Agriculture and Stock.

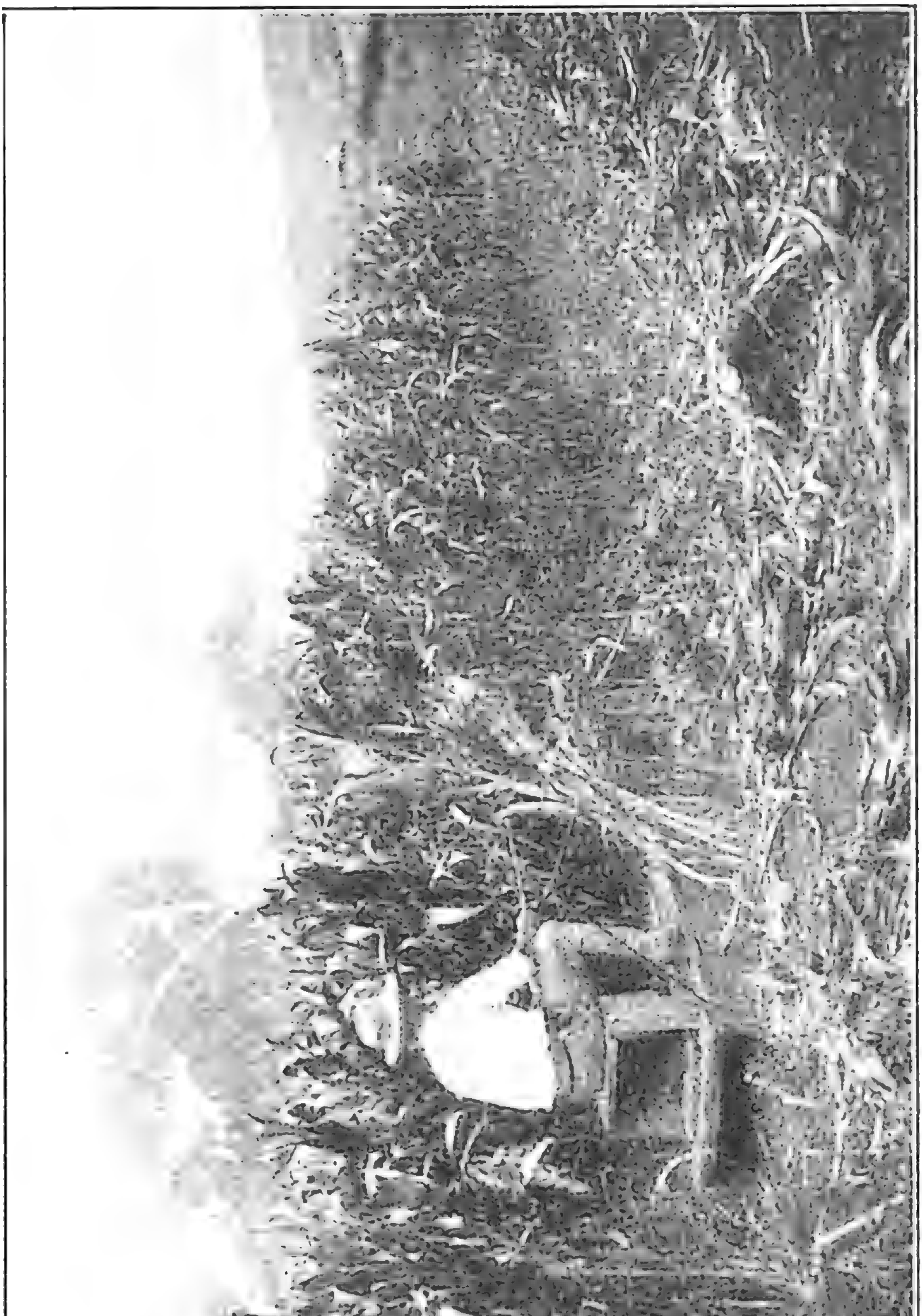

Plate 233.
A sledge cutter at work in an immature maize crop.

*"Millets" and "Panicums".

Description.—There is a good deal of confusion regarding the identity of the various types of quick-maturing fodder plants embraced in the terms "millets" and panicums." The following classification is adopted in this discussion:—

White Panicum (*Echinochloa crus-galli* var.). (Plate 234.)

Japanese Millet (*Echinochloa crus-galli* var. *edulis*). (Plate 234.)

French Millet (*Panicum mileaceum*).

Giant Setaria (*Setaria italica*). (Plate 235.)

Dwarf Setaria (*Setaria italica*).

Climatic Requirements.—The various plants listed above are all summer-growing annuals which are readily killed by frosts. They exhibit drought resistance in varying degrees, but all are able to survive short periods of dry weather and to develop on a fairly low rainfall. Even in our driest agricultural districts they can be relied upon to produce feed in most years.

Soils.—Whilst they do well on a variety of soil types, fertile clay loams or sandy loams are favoured.

Planting.—The millets, &c., are all propagated by seed and from 10 to 15 lb. per acre of seed are necessary to produce a good stand. The quality of the seed is usually high and a minimum germination percentage of 75 for commercial seed is prescribed by the Pure Seeds Acts. The seed may be broadcast or drilled and should, of course, be sown on well-prepared land. Sowings may be made at any time during spring or summer and often the crop is used as a catch crop, to take the place of an agricultural crop which has failed for one reason or another. Good grazing will be provided in five to six weeks if weather conditions are favourable.

Management.—The crop should be permitted to establish properly before being grazed off. Usually 8 to 9 inches of top-growth should be allowed to develop. After the initial grazing, if this is not made too late, the crop will respond fairly well and produce a second grazing or cutting.

Conservation.—The millets, panicums, &c., make a good class of hay, if cut when the grain is forming. Owing to their succulent nature, they take some time to cure. The plants are also very suitable for silage.

Feeding Value.—All classes of stock find these crops very palatable and their nutritive value is high.

Undesirable Features.—Owing to their free-seeding habit the danger of volunteer growth of millets to succeeding crops is high and care should be taken to prevent the ripening of seed if subsequent extra working of the land is to be avoided.

* A special pamphlet dealing with millets, &c., is available on request to the Department of Agriculture and Stock.

Plate 234.

Seedheads of various millets. From the left—white panicum, Japanese millet, and three forms of wild millets.

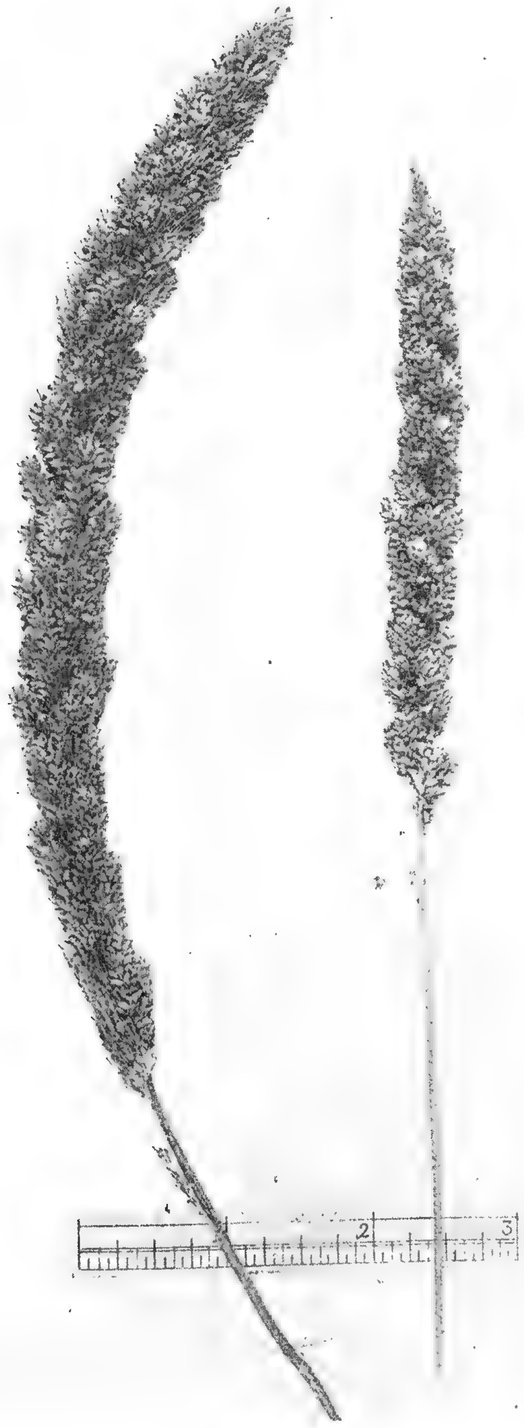

Plate 235.
Seedheads of two forms of Setaria.

* Cowpea (*Vigna unguiculata* (L.) Wallp.).

Origin and Distribution.—The original home of the cowpea was Central Africa, but it has been cultivated for many centuries in the warmer parts of the Old World and in addition is extensively grown in the Americas and in Australia. Its main uses in Queensland are green-manuring, fodder and hay.

Description.—The cowpea (Plate 236) is a fairly shallow-rooted, annual plant with a branched tap-root. According to the variety the growth habit varies from trailing vines to tall, bushy forms. The large leaves consist of three leaflets. The flowers are white, or pale violet, and the cylindrical pods are several inches long. The pods are filled with numerous speckled, bean-shaped seeds.

Plate 236.

A cowpea crop on a North Queensland farm.

Climatic Requirements.—Being of tropical origin, the cowpea is a summer-grower, but is able to thrive on a fairly low summer rainfall. In Queensland it is used in all the agricultural districts, including the fairly dry Maranoa district. It is not sufficiently drought-resistant, however, to really thrive in low rainfall areas. Frosts are destructive of the crop.

Soils.—The cowpea will grow on many different types of soil, provided they are well-drained, and will thrive on soils more acid than those required by lucerne.

Planting.—It is necessary to till the land well before planting. The seed should be planted after danger of frosts has passed, and may be broadcast at the rate of 25 to 40 lb. per acre or drilled in rows 2 feet 6 inches apart, 5 to 15 lb. of seed per acre being used. Locally suitable varieties should be used.

* A special pamphlet is available from the Department of Agriculture and Stock.

Management.—The crop can be grazed by stock during its growing period. For hay purposes, it is best cut when a fair proportion of the flowers have formed pods. The crop is somewhat difficult to cure properly.

Feeding Value.—The feeding value of cowpea, both green and cured, is excellent. Dairy stock do not readily take to the green material at first, but later acquire a taste for it.

* Velvet Bean (*Mucuna* spp.)

(including Mauritius Bean (*Mucuna aterrima* Holl.) and Florida Velvet Bean (*Mucuna deeringiana* (Bort.) Holl.).

Origin and Distribution.—The various types of velvet bean are natives of tropical countries and are employed in a number of tropical and subtropical areas chiefly for green manure purposes. It is for green manure that the crop is mainly used in Queensland, but it is utilised also for grazing, though only to a small extent.

Plate 237.

Velvet beans growing amongst maize.

Description.—Velvet bean (Plate 237) is an annual plant, varying in habit from bush types to vine types. The plants have fleshy surface roots and stems and the vine types often spread over a large area. The leaves are large and occur in groups of three leaflets. The large flowers are borne singly or in small groups and are variously coloured from white to purple. The pods are from 2 to 6 inches long and in some varieties are hairy. The seeds are large, but vary in shape from globular to oblong and are white, mottled, brown or black in appearance.

* A special pamphlet is obtainable from the Department of Agriculture and Stock.

Climatic Requirements.—The velvet bean is a summer grower and requires a fairly heavy summer rainfall and a long growing season. Best results are obtained in the tropical north coast: elsewhere cowpeas usually are employed as an alternative to velvet bean.

Soils.—A well-drained fertile soil is desirable, and a wide range of soil types is suitable for the crop. It will grow on soils too acid for lucerne or clovers.

Planting.—Sowing should not be commenced until danger of frosts is passed, but early sowing is desirable, especially of the late-maturing varieties. The land should be well cultivated. The method of planting varies according to the purpose of sowing. When sown in a pure stand for hay, grazing or green manure, the crop is planted in drills 4 or 5 feet apart, with 12 to 18 inches between the seeds. Between 10 and 20 lb. will seed an acre.

Sometimes velvet bean is sown with maize or sorghum to provide a mixed grazing or silage crop. The bean seed may be sown either at the same time as, or later than, the maize or sorghum seed.

Management.—In the early stages of growth of the velvet bean, weeds should be kept down by cultivation. When the plants are well established, grazing may be commenced, but should be intermittent in character.

Conservation.—For hay purposes, velvet beans are best harvested by hand-cutting, when the crop is in early flower. The wilted plants are cocked for a few days before stacking. When grown in a mixed stand, a useful silage may be made from velvet beans.

Feeding Value.—The vines are extremely palatable to stock and possess a high feeding value. The mature beans also provide good feed.

* **Peanut** (*Arachis hypogea* L.).

Origin and Distribution.—A native of Brazil, the peanut is grown in a number of tropical and subtropical countries for the edible "nut" which it produces. In Queensland a fairly large area in the Burnett, and in more tropical districts, is sown annually to the crop.

Description.—The peanut is a thick-stemmed annual plant of either bushy or creeping habit and possessing a thick tap-root. There are four large leaflets in each leaf, and the stemless, yellow flowers occur at the bases of the leaves. When the flower is fertilized, it develops a long stalk, which carries the flower (minus its petals) into the ground, where the fruit is matured.

Climatic Requirements.—A long, warm-growing period, with moderate rainfall, is necessary if fruit is to be matured.

Soils.—Loose-textured soils are essential to permit of the flower being buried and to facilitate harvesting, and light, sandy loams, not too acid and with a good humus content, are recommended.

Planting.—A well-tilled seed-bed should be provided and the seed sown in spring or early summer in drills.

Management.—Whilst the usual practice is to market the nuts and to cure the tops for feeding to stock, on occasions the standing green crop is grazed, especially by pigs, which are able to use also the underground nuts.

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*A special pamphlet dealing with peanut cultivation is available.

Conservation.—Peanut tops make a very rich hay and should be cured in the manner recommended in the special pamphlet, which is available from the Department of Agriculture and Stock.

PERMANENT WINTER-GROWING GRASSES.

Toowoomba Canary Grass (*Phalaris tuberosa* L.).

Origin and Distribution.—Though it might appear from the common name of this grass that it is a native of Queensland, the plant originated in the Mediterranean region. It was introduced to Australia for trial purposes over 50 years ago, being first sown in this country at the Toowoomba Botanic Gardens in 1884. Small quantities of seed were distributed from Toowoomba to various States, but it was not until twenty years after its introduction that it came to the notice of agriculturists in Southern Australia as possessing the valuable properties of drought-resistance, permanency, high productivity and adaptability to varying soil types. It was slowly brought into more extensive use, and during recent years the demand for seed has been heavy.

Plate 238.
Phalaris tuberosa.

Description.—*Phalaris tuberosa* is a deep-rooted perennial plant, which increases in size by means of short, underground runners. The tufts produce, during the winter and spring months, a large quantity of palatable and nutritious leafage. The production of seed stalks is limited under grazing conditions.

Climatic Requirements.—For maximum production during its autumn-spring growing period, Phalaris requires a moderate to heavy winter rainfall, and is best suited to areas experiencing such conditions. It is, however, fairly productive during short, dry periods, although dormant under drought conditions. Severe frosts do not injure the grass.

Soils.—So far as soil conditions are concerned, Phalaris prefers a rich, well-drained soil, but will do well on a wide range of soil types possessing these characteristics. The nitrogen requirements of such a high-producing grass as *Phalaris tuberosa* are high, and soils rich in organic matter or other form of nitrogen should be selected.

Planting.—The sowing of Phalaris pastures should be performed during the autumn months. The seed is of light weight, and as only a small bulk per acre is required, the seed should be mixed with some filler, such as superphosphate or sand, to facilitate distribution, whether by drilling or by broadcasting. *Phalaris tuberosa* seed is somewhat erratic in its behaviour, as far as germination is concerned. Some lots germinate well over 80 per cent., other lots fail to reach the 55 per cent. minimum, which operates in most States. It is advisable to purchase Government Certified seed, which, in addition to being approved with regard to origin, also carries a seed-tester's certificate, showing the percentage germination at the time of testing. By purchasing Government Certified seed the buyer can be certain of securing seed from pastures of a truly perennial type, and does not run the risk of purchasing seed contaminated with seeds of short-lived types of Phalaris.

Phalaris is a grass which takes some time to establish its root system, and is sensitive to severe competition during its early stages. Consequently, care should be taken that the grass is sown only under conditions in which it will not be subject to heavy competition for soil moisture, &c. For instance, it should not be sown on poorly-worked cultivations contaminated with weed seeds; nor simply broadcasted on existing pastures. The only really satisfactory way of establishing good Phalaris pastures is to sow down on fertile, well-cultivated soils with a minimum of other plants in the mixture. A legume is desirable in the pasture and lucerne, red clover or white clover could be included without affecting the establishment of the Phalaris. Sometimes a light seeding of quick-growing grasses, such as rye grasses, is made to provide feed while the Phalaris is establishing, but in most instances, the Phalaris should be given the least possible opposition. The rate of sowing should be about 4 lb. per acre of Phalaris seed, together with 2 lb. of seed of one of the legumes.

Management.—A pasture of Phalaris should be permitted to establish itself before being grazed, and during the first year only light intermittent grazings should be made. In subsequent years the pasture will stand up to heavy stocking at intervals, provided sufficient time for recovery is allowed between grazings. Whilst Phalaris will make some growth during the summer months, it is inadvisable to subject the grass to grazing conditions then, since the plant is weakened and will not produce heavily during the following growing season.

Like paspalum, Phalaris is likely to become sod-bound after a few seasons of grazing, but the pasture can be kept in good condition by periodical renovation, commencing during its second season of growth. Renovation is best effected by means of a drastic harrowing with a rigid tine implement of deep penetration. The operation should be carried out in spring, so that the storms which may be expected at that time will help the torn plants to recover.

Conservation.—Phalaris makes a very fine type of hay and a useful silage.

Feeding Value.—All classes of stock relish the succulent feed produced by Phalaris, and the grass is extremely valuable for fattening and for cream production.

Seed Production.—It is probable that the growing of Phalaris for seed would prove satisfactory at one or two centres on the Darling Downs, but under general grazing farm conditions seed production is very unreliable.

Perennial Ryegrass (*Lolium perenne* L.).

Origin and Distribution.—A native of Europe, perennial ryegrass now enjoys considerable favour in many temperate and cold temperate climates. It is of considerable importance in New Zealand, South Australia, Victoria, Tasmania, and New South Wales, but in Queensland has a very limited distribution.

Description.—Perennial ryegrass is a long-lived tufted grass with characteristic soft, green leaves. It tillers well and forms a close sward. The leaves may reach a length of 18 inches, under favourable conditions.

Climatic Requirements.—The climates in which perennial ryegrass thrives are those of New Zealand, England, and like climates, and the climate of Queensland is for the most part unsuited to the grass. The main causes of the failure of the grass in most parts of Queensland are dry winter conditions (i.e., during the normal growing season of the grass) and high summer temperatures. When one or both of these conditions are not severe some success has been attained, e.g., on the southern highlands and on moist soils on the south coast.

Soils.—Perennial ryegrass will thrive only on well-drained fertile soils. It is definitely not a suitable grass for sowing under any but good conditions of soil and climate.

Planting.—Sowing of perennial ryegrass should be carried out in the autumn following adequate preparation of the soil. Commercial seed is usually of good quality, and a minimum germination percentage of 60 per cent. is prescribed by the Pure Seeds Acts. The question of the variability of perennial ryegrass, according to its place of origin, has been studied in some detail, and as a result seeds carrying a Government guarantee of conformity to a desirable pasture type are on the market. Such seed should be purchased in preference to uncertified seeds, which may or may not be from desirable pastures. The field germination of perennial ryegrass is very reliable.

In those restricted areas, to which perennial ryegrass is suited, permanent winter pasture mixtures should have this grass as their basis. The other plants in the mixture should include a clover and one of the annual ryegrasses to provide some quick feed while the perennial plants are becoming established.

Management.—Pastures of perennial ryegrass will withstand fairly heavy grazing, but intermittent grazing is desirable. The pasture should be spelled during the summer months.

Conservation.—Perennial ryegrass may be conserved as hay or as silage. For silage purposes the grass should not be harvested whilst in a very young condition.

Feeding Value.—In most instances perennial ryegrass is very palatable to all classes of stock. Its feeding value is of a high order and the grass is particularly valuable for dairy stock.

Cocksfoot (*Dactylis glomerata* L.).

Origin and Distribution.—Cocksfoot is a native of Europe but is now cultivated for grazing in Africa, Asia, America, New Zealand, Australia and other countries. In Queensland it is grown to only a small extent, chiefly on elevated coastal country in the south-east.

Description.—Cocksfoot is a perennial grass of tufted habit, with dark green leaves. It is an extremely leafy grass, producing very few flower stalks. In the best types leafy shoots are produced in profusion from the whole of the crown; in inferior types the shoots are mostly marginal.

Climatic Requirements.—Cool, moist conditions rather than the hot and oftentimes dry climate of the Queensland grazing areas are most favourable to cocksfoot: hence the grass is really successful only in the Springbrook, Tamborine, Maleny and Granite Belt areas. Elsewhere it is not likely to become more than a minor pasture grass.

Soils.—An important feature of cocksfoot is its adaptability to a wide range of soil types. Under suitable climatic conditions it will thrive in almost any type of agricultural soil except sands. Moist clay loams suit it best.

Planting.—Sowings of cocksfoot should be made in the autumn months, as the seedlings require cool conditions during establishment. The germinating capacity of commercial cocksfoot seed is seldom very high, a sample germinating 75 per cent. being considered quite good. The Pure Seeds Acts prescribe 50 per cent. as the minimum and occasional samples are below standard. The productive period of cocksfoot is during spring and summer, though it is able during the cooler months to provide some feed. As a component of permanent winter pasture mixtures it is valuable in extending the grazing season into the warmer months. Because of its cool weather production it is useful also in paspalum pastures. If sown alone cocksfoot should be sown at the rate of 15 to 20 lb. per acre in order to encourage a thick sward. If a good initial stand is not obtained the pasture is inclined to become tussocky.

Management.—Intermittent grazing should be practised and regular light harrowings given.

Conservation.—No cocksfoot hay is conserved in Queensland, though the grass is cultivated for hay purposes in some temperate countries.

Feeding Value.—The palatability of cocksfoot is fairly good and its feeding value is of a high order.

Seed Production.—Under Queensland conditions little seed is produced by the grass and collection is not economic.

SELF-GENERATING ANNUAL WINTER-GROWING GRASSES.

Wimmera Ryegrass (*Lolium* (?) *subulatum* Vis.).

Origin and Distribution.—Believed to have been brought from Europe to Victoria in 1887, Wimmera ryegrass is now a widely used grass in fairly dry areas in various Australian States. It has been used spasmodically in Southern Queensland for many years but it is only recently that any extensive area has been sown.

Description.—Wimmera ryegrass (Plate 239) is a tufted annual plant, very soft in nature but producing many stems, which reach a height of about 18 inches. These stems are produced in abundance in the early spring and seed is set early, after which the plant dies off.

Climatic Requirements.—Since it is a winter growing grass, Wimmera ryegrass requires winter rains for its growth. It adapts itself to

a range of winter rainfall conditions but the minimum rainfall below which it is unproductive is often not reached away from the south coastal area. In years of reasonable rainfall, however, Wimmera ryegrass does quite well in the southern parts of the State as far west as the Maranoa district. Being an annual, Wimmera ryegrass hastens to produce seed in the spring and the length of the grazing period varies considerably according to the seasonal conditions experienced.

Soils.—When grown under low rainfall conditions, Wimmera ryegrass requires to be sown on fertile soil types. In higher rainfall districts it should be reserved for the poorer classes of cultivated land and Italian ryegrass sown on the richer soils for annual winter grazing.

Plate 239.
Wimmera ryegrass.

Planting.—Wimmera ryegrass should be sown down in early autumn on cultivated land. The seed is usually of good germinating power and the grass establishes quite readily in the field. On the South Coast, as much as 8 to 10 lb. per acre may be sown; 4 to 6 lb. per acre, together with 2 lb. of lucerne, should suffice in drier areas.

Because of its easy establishment and quick growth, Wimmera ryegrass is useful for some special purposes. It is often included, in small amounts, in permanent winter pasture mixtures, to provide some grazing while the slower-growing perennials are becoming established. Sometimes it is sown on old lucerne stands to provide better grazing than the weedy grasses which would otherwise invade the area. Quite often it is sown down between the rows of a maize crop at the time of final scuffling to provide grazing when the crop is harvested.

Management.—Intermittent grazing should be practised with Wimmera ryegrass, as with other pastures. In addition, the pasture must be spelled when seed is being set in order to assist the grass to re-establish itself from self-sown seed. After the seed is shed, the dry plants can again be grazed by stock. If the grass is to be cut for hay, grazing should be discontinued sufficiently early to allow of a good hay crop being formed by the spring.

Conservation.—A fairly good hay can be made from Wimmera ryegrass cut before maturity.

Feeding Value.—The palatability of the grass in the green state is good and stock will also eat the mature plants. The feeding value, which is excellent in the younger stages, declines rapidly after maturity.

Seed Production.—Several growers of Wimmera ryegrass in Southern Queensland have collected seed from their paddocks. The grass seeds very profusely and the seed does not shatter easily. The practice adopted has been to mow the grass and thresh it with the ordinary grain thresher.

Pests and Diseases.—Rust occasionally affects Wimmera ryegrass and considerably lessens its grazing value.

Prairie Grass (*Bromus unioloides* H.B. et K.).

Origin and Distribution.—Prairie grass is a native of temperate South America, where it forms an important part of the grazing lands of Argentina, Paraguay, &c., and has now a wide distribution in temperate and warm temperate countries. In Queensland it is common in most of the eastern areas as a weed in sheltered situations, but it is only in the southern districts that it is used extensively for pasture purposes.

Plate 240.
A prairie grass pasture.

Description.—In habit prairie grass is usually annual or biennial, though long-lived types have been obtained and are on the market. The grass forms somewhat small tufts, but tillers quite freely, and the erect stems produce abundant leaf. The very large "seeds" occur in narrow panicles on the seed stalks. The perennial form of prairie grass, which until recently was believed to be entirely different from the common prairie grass, was discovered in New South Wales a few years ago, and has been sown on a small scale in Queensland and New South Wales. Its main point of difference from the annual prairie grass is its long-lived habit. Instead of dying after running to seed

before the summer, perennial prairie grass continues to live and to produce feed. Its summer production of leaf is not very large and if the pasture is grazed heavily the crown of the plant is exposed to the heat of summer, and damage results. In Queensland, there is a fairly high mortality among established plants each year, but self-sown seed helps to keep the pasture thick.

Climatic Requirements.—Prairie grass is a winter-growing plant and consequently requires early autumn rains for its germination and follow-on rains to keep it productive until the late spring, when normally it goes to seed and dies off. Only in the southern parts of the State is the autumn-spring rainfall sufficient to produce good prairie grass pastures.

Plate 241.
Prairie grass in seed.

Soils.—Rich loams are the most suitable soil types for prairie grass. On heavy clay soils it is of lesser value, whilst on sandy soils it is of little use.

Planting.—Seed of prairie grass should be sown in the autumn, preferably on well-prepared land. Although the parts of the seed head which are sold for sowing are quite large, the actual seeds within these parts are not very big and only a light covering of the seed should be made. Commercial seed of prairie grass is extremely variable in quality. Some lots will germinate as high as 96 per cent., while occasional lines are quite valueless. The Queensland Pure Seeds Acts

prescribe 50 per cent. as the minimum germination permitted. The main causes of low quality seed are harvesting when immature and smut infection. Farmers growing prairie grass for seed purposes require before sowing their seed areas to treat the seed with a disinfectant, such as a mercury dust (e.g. Abavit B or Ceresan at the rate of 3 oz. for every 20 lb. of seed) or a solution of formalin (1 pint of 40 per cent. formalin to 30 gallons of water—sprinkle over the seed at the rate of 1 gallon per bushel the day before sowing).

Management.—The chief use of prairie grass is for winter grazing, either in admixture with summer-growing plants or as a pure stand. It is difficult to maintain prairie grass in association with good grazing types, because of its tendency to be eaten out by stock. The grass forms a crown above the surface of the soil and heavy grazing soon destroys the plants. In order that grazing may be rigidly controlled to prevent the grass being eaten out, prairie grass is best sown apart from other winter grasses. It is commonly sown, however, in Rhodes grass pastures to provide grazing during the dormant period of the Rhodes grass. When sown alone, up to one bushel of seed per acre is recommended. In mixtures, 4 to 5 lb. should suffice. If permitted to seed at the end of its growing season, prairie grass will re-establish itself each year.

Conservation.—Prairie grass is seldom utilised for other than pasture purposes, though it makes a very good hay.

Feeding Value.—Wherever it is grown prairie grass is recognised as one of the sweetest and most nutritious grasses. It is relished by all classes of livestock, has a high feeding value, and is a good cream producer.

Pests and Diseases.—Prairie grass is subject to attack by the smut fungus, which prevents seed formation, and should be protected by seed disinfection. A special pamphlet dealing with the process is available from the Department of Agriculture and Stock, Brisbane.

PERMANENT WINTER-GROWING PASTURE LEGUMES.

White Clover (*Trifolium repens* L.).

Origin and Distribution.—A native of Europe, white clover is the most commonly used leguminous constituent of permanent pastures in practically all temperate countries, including western European States, the United States of America, New Zealand and Southern Australia. Its range extends into subtropical areas, and in Australia white clover is a common naturalised clover in the coastal paspalum-growing areas of New South Wales and Queensland.

Description.—White clover is a perennial legume, with prostrate running stems. There are a large number of commercial types of the clover, which show extensive variation as regards runner development, density of growth, size of leaf, &c. The general habit of the clover is to spread by means of the creeping stems, which root at the joints. Leaf stalks and flowering stems arise from the joints. Each leaf stalk attains a height of 3 to 18 inches, depending on soil and climatic conditions, and bears three leaflets. The flowering stems grow upright and each terminates in a white globular head of flowers.

Climatic Requirements.—The late winter and spring months cover the usual period of growth of white clover in Queensland. What are recognised as good clover years occur on an average once in four or

five years, and are characterised by a higher winter rainfall than usual and moist and cool early spring months. Growth is retarded by very warm weather and ceases early in the summer. August to November is the main growing period, and a rainfall of about 12 inches in the May-October period is considered essential for good clover development.

Soils.—Provided sufficient moisture is available, white clover can be grown on a wide range of fertile soil types, but prefers loamy types to sandy or excessively clayey soils. The acidity of the soil must not, however, be high, though white clover is less exacting in its requirements than is lucerne. It is essential that the soil be rich in available plant foods.

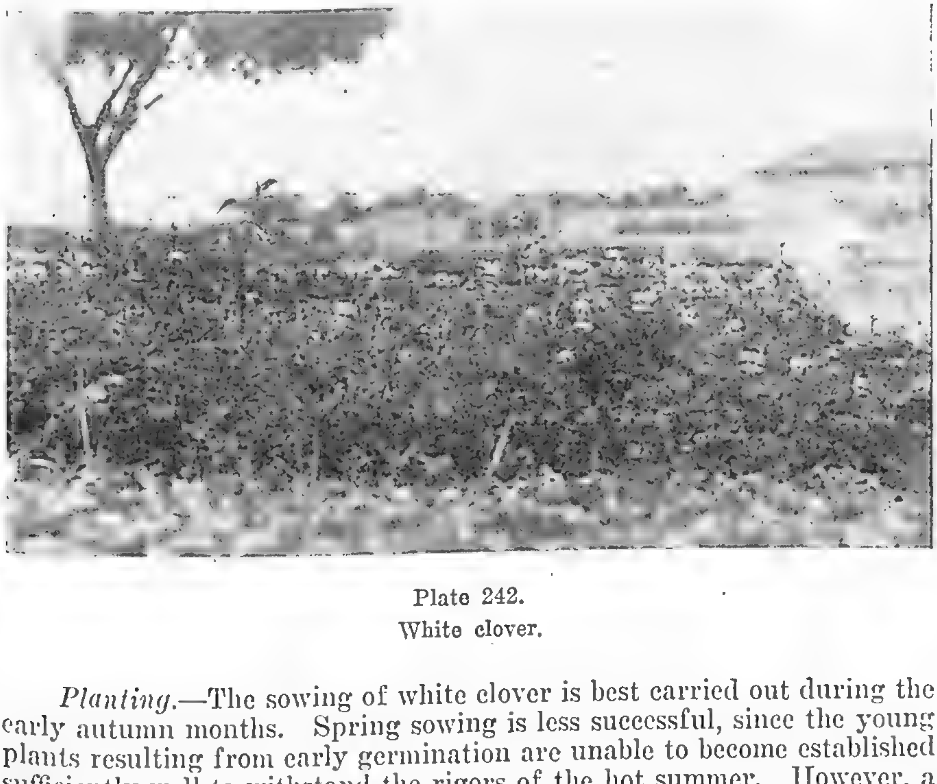


Plate 242.
White clover.

Planting.—The sowing of white clover is best carried out during the early autumn months. Spring sowing is less successful, since the young plants resulting from early germination are unable to become established sufficiently well to withstand the rigors of the hot summer. However, a proportion of the seed will lie dormant until the following autumn. Seed of white clover is readily obtainable from seedsmen and is usually of good germinating capacity. A minimum germination percentage of 70 is considered desirable.

The main use made of white clover is in permanent pasture mixtures, and it is either sown down when the pasture is being sown or else it is incorporated in existing permanent pastures. White clover is of particular value in conjunction with paspalum and with Kikuyu grass and is readily established by sowing down on renovated grass areas in the early autumn. In order to encourage the early development of the clover superphosphate should be sown with the seed. Two pounds of white clover seed sown on an acre of renovated grass pasture should form the nucleus for a fairly extensive spread of clover over the area. After the seed is sown, it should be given a light covering by running harrows over the land.

When permanent winter pastures are being sown in suitable districts 2 lb. of white clover seed should be included in the mixture.

The naturalised form of white clover, which is fairly common in some paspalum pastures, has been developed from European types, particularly the white Dutch clover, and tests which have been carried out have shown New Zealand selected types to be superior to the naturalised and European types, consequently New Zealand Government Certified White Clover Seed or the cheaper New Zealand Superfine White Clover Seed should be used, the former for preference.

Management.—The type of management imposed on white clover depends usually on the type of pasture of which it is a component. The system of intermittent grazing suits the clover quite well, since it permits of the accumulation in the roots of food reserves which enable the clover to "come away" quickly after its dormant period, and in addition it prevents excessive shading of the clover.

In some years white clover grows in such profusion that there is considerable risk of stock being "bloated." The usual means to prevent hoven or bloat should be employed.

Since the flower heads of white clover usually are not eaten by stock, no special precautions to ensure the ripening and shedding of seed appear to be necessary.

Conservation.—White clover is primarily a pasture species and is not particularly suitable for use as hay or silage.

Feeding Value.—The palatability and feeding value of the clover when growing in pasture mixtures are good, though a diet of clover alone is unbalanced. The high percentage of leaf among the material available to stock is responsible in a large measure for the high feeding value of the plant.

Undesirable Features.—Injudicious grazing of white clover might result in "bloating" of ruminants.

Red Clover (*Trifolium pratense* L.).

Origin and Distribution.—Red clover, or cow-grass, is a native of Europe and is extensively grown for pasture and hay purposes in temperate countries, including England, United States of America, New Zealand and Southern Australia. In Australia it is used also for winter grazing on the north coast of New South Wales and in south-eastern Queensland.

Description.—In habit, red clover is an upright plant with hairy stems and large hairy leaves. The flowers are borne in fairly large globular heads and are reddish-purple in colour. In temperate areas with a well-distributed rainfall, some strains of red clover are long-lived perennials, persisting for four or five years. Under Queensland conditions two or three years is the maximum life of the plant.

Climatic Requirements.—Though commonly regarded as a winter-growing clover, red clover makes its main growth from August onwards and produces feed right through mild summers. Hot, dry conditions persisting for some time destroy the plants, hence the tropical coast and the drier areas of the State are unsatisfactory for red clover. Only the south-eastern portion of the State appears to be climatically suitable for it.

Soils.—The soils favoured by red clover are clays and clay loams not subject to waterlogging and of alkaline or slightly to moderately acid nature. Medium and strongly acid soils are unsuitable.

Planting.—Owing to the danger of bloating, red clover is seldom sown in a pure stand for grazing purposes. Its main uses are for sowing down in admixture with annual or semi-permanent winter and spring growing pasture mixtures and for sowing down on renovated paspalum pasture. In all mixtures the amount of seed sown per acre should not exceed three pounds. Seed is readily obtainable from seedsmen and is usually very reliable. Seed lots germinating less than 75 per cent. should not be accepted.

Management.—In common with other pasture plants red clover should be grazed intermittently and not continuously. Close grazing is likely to damage the crown of the plant. Where red clover is plentiful in pastures, precautions against bloating of stock must be taken. There is little point in spelling the clover to permit of seed production, for, whilst it does mature a certain amount of seed if rested, red clover is not very efficient in sowing itself down.

Conservation.—In suitable districts a good quality hay may be made from red clover, and when ensiled in admixture with grasses, the clover adds to the value of the resultant silage.

Feeding Value.—The palatability of red clover is somewhat variable, its hairiness apparently sometimes making it unattractive to stock. However, young growth mixed with grass is eaten readily. The nutritive value of the clover is high before the plants become stemmy in nature.

Seed Production.—The amount of viable seed produced under Queensland conditions is small and the growing of the clover for seed production purposes is unlikely to be a successful commercial proposition.

Special Uses.—Red clover is occasionally sown in New South Wales as a rotation crop with maize and may have some value for this purpose on alluvial flats on the coast in Queensland.

Undesirable Features.—The succulent character of red clover renders "bloating" a danger if proper precautions are not taken.

Alsike Clover (*Trifolium hybridum* L.).

Origin and Distribution.—Alsike clover is a native of northern Europe and is cultivated there and in other cool temperate countries. It is very little used in Australia, where red clover and white clover can be grown with greater satisfaction.

Description.—Though in suitable countries Alsike clover has a life period of 4 to 6 years, in Queensland it is very short-lived and may be regarded as an annual. It is an upright, leafy plant with branching stems and a thick taproot. The leaflets occur in groups of three and the white or pink flower heads are borne on long stems. The small pods each have 2 to 4 seeds.

Climatic Requirements.—Alsike clover is a winter and spring grower, which requires a fairly moist growing season. In Queensland it usually dies in early summer owing to the heat.

Soils.—Most moderately fertile soils are suitable for Alsike clover and it will thrive on fairly moist soils.

Planting.—Alsike clover is not likely to be used to any extent in Queensland, and if its use is increased it will probably be in winter pasture mixtures, when one pound of seed per acre should suffice.

Conservation.—A good quality hay is made from Alsike clover.

Feeding Value.—The feeding value of the clover is quite good, but "bloating" must be guarded against.

Strawberry Clover (*Trifolium fragiferum* L.).

Origin and Distribution.—Strawberry clover is a native of the Mediterranean regions of Europe, Asia and Africa and is cultivated to a small extent in various warm temperate areas. In Australia it is utilised in the Southern States for growing in damp areas, but Queensland experience with the clover is too limited to generalise regarding its potential usefulness in this State.

Description.—Resembling white clover in habit, strawberry clover is a perennial plant with creeping and rooting stems and erect leaf stalks and flowering stems. Each leaf stem carries three leaflets and the globular flower head, when mature, has the appearance of a strawberry fruit.

Climatic Requirements.—Strawberry clover makes most of its growth during the warmer months of the year and requires a well-distributed annual rainfall if not grown in damp places. It will not do too well in hot, dry weather unless supplied with abundant soil moisture.

Soils.—Provided soil conditions are not extremely acid, strawberry clover will grow on all fairly fertile moist soils.

Planting.—If runners are not readily available the clover should be started by sowing seed, but planting of runners is much more reliable.

Management.—The clover is well adapted to grazing and will survive heavy stocking if given time to recover between grazings.

Feeding Value.—Its palatability and feeding value are good.

SELF-GENERATING ANNUAL WINTER-GROWING LEGUMES.

Burr Medic (*Medicago denticulata* Willd.).

Origin and Distribution.—The native home of burr medic, which is also known as burr clover, burr trefoil, trefoil or clover, is Europe, but the plant now has a wide distribution in many other temperate countries, including Argentina, United States of America, and Australia. It is naturalised in some parts of Queensland, particularly on the Darling Downs and in the Maranoa and in addition is sown to a small extent.

Description.—Burr medic is an annual plant with prostrate or weakly ascending stems. The leaflets are borne in groups of three at the end of a long leafstalk and have serrated edges. The flowers are small and yellow and occur in groups of 2 to 8 on short stalks. The pods are disc-shaped and are made up of two or three coils. They are about ¼ inch in diameter and are covered with hooked spines.

Climatic Requirements.—Whilst burr medic makes its early growth during the winter months, it prefers mild winter growing conditions to very cold conditions and its most rapid development is made during the warm months of early spring. As hot weather commences the plant dies off. The seeds germinate in autumn and fairly regular winter rains are required to keep the plants growing. Nevertheless, the legume can survive moderately long, dry winter periods and is one of the hardiest of the fodder legumes.

Soils.—The soils most favoured by burr medic are the heavier types of alluvials or basalt soils, and these must be well supplied with lime. The very acid soils of the coast are unsuitable, as are also sandy soils.

Planting.—Most of the burr medic grazed in Queensland is of voluntary growth and little is sown. Seed is, however, available at a cheap rate and areas of native pasture in which the legume does not occur might, in suitable districts, be sown with seed of the legume. Sowing must be carried out in the autumn and 2 lb. of seed per acre should suffice in most southern districts.

Management.—Prevention of bloating is the chief point to observe in the grazing of burr medic. It is necessary also that the plant be permitted to seed itself down in early summer and this means protection or light stocking while the pods are maturing. The plants produce abundant pods, each with 3 to 6 seeds, and these lie in the ground until the seeds germinate with autumn rains.

Conservation.—In certain districts burr medic grows in sufficient quantities to merit its conservation as silage.

Feeding Value.—The young green plants do not appear to be as palatable to stock as semi-mature growth or green material cut and wilted. The protein and mineral contents are high in both young and fairly old plants and the legume is a very useful fodder. The seeds after being shed are readily eaten by stock and provide a good deal of nutritious feed.

Undesirable Features.—In wool-growing districts, burr medic causes some trouble, because of the tendency of the hard, spiny pods to cling to the fleece.

Black Medic (*Medicago lupulina* L.).

Origin and Distribution.—Black medic, which also is known as English trefoil or yellow trefoil, is a native of Europe, and is used to a slight extent in various other temperate areas. Though it has been naturalised in Australia for many years, it has not spread naturally to any great extent and is found chiefly in cool districts. On the New England Tableland of New South Wales the legume is fairly widely used in pasture mixtures, but its present use in Queensland is very limited.

Description.—The legume is a mixture of perennial and annual types, but under Queensland conditions appears to behave for the most part as an annual. The plant has small leaves and prostrate stems. The flowers are small and yellow and are borne in globular heads on the end of fairly long-flowering stems. The pods are free of spines but are twisted.

Climatic Requirements.—Black medic is a winter and spring grower and prefers a cool, moist growing season. It provides earlier feed than most other legumes, but also matures fairly early. It has a moderate degree of drought resistance, being intermediate in this respect between white clover and lucerne.

Soils.—Black medic evinces a preference for heavy soils and is of little value on sandy soils. Acid soils are apparently unsuitable and soils lacking in phosphates require the application of a phosphoric manure to encourage the legume.

Plate 243.
Burr Medic.

Planting.—Pure stands of black medic do not form a suitable type of pasture and the main use of the legume is in pasture mixtures. Two or three pounds per acre in winter pasture mixtures are recommended and similar quantities may be sown on renovated Rhodes grass or native grass pastures. Autumn sowing is desirable.

Feeding Value.—Both the palatability and the feeding value of black medic are good.

Clustered Clover (*Trifolium glomeratum* L.).

Origin and Distribution.—A native of the Mediterranean region and western Europe, clustered or ball clover is a hardy annual naturalised in all States of Australia and sown to a slight extent for pasture improvement. In Queensland it is common on fairly dry soils along the coast and in the drier agricultural districts.

Description.—The plant is an annual with spreading prostrate stems along which leaves are produced on fairly short stems. Globular heads of pink flowers are formed at the base of the leaf stalks and themselves have no stalk. Small pods are produced, each of which contains one or two small seeds.

Climatic Requirements.—Clustered clover germinates in the autumn but makes little growth until the warm months of early spring. In

late spring it goes to seed and dies off when the summer commences. The clover is fairly drought resistant and will develop on a low winter rainfall, though not much feed is produced if the June-August rains are light.

Soils.—On all well-drained soils of fertile character clustered clover can be relied upon to produce some growth in most seasons, but some encouragement in the shape of fertilizer may be necessary to produce worthwhile grazing.

Planting.—Clustered clover merits sowing in native pastures on fertile soils not moist enough to support the better winter and spring growing clovers. Such pastures, after discing or other harrowing, should be improved by the broadcasting of 2 to 3 lb. of clustered clover seed per acre.

Management.—The clover depends for its persistency on self-sowing and though it will set seed under fairly close grazing conditions, it is advisable to encourage seeding by spelling the pasture at the appropriate time.

Feeding Value.—All classes of stock find clustered clover palatable and it makes a nutritious feed.

Subterranean Clover (*Trifolium subterraneum* L.).

Origin and Distribution.—Subterranean clover is a native of Mediterranean regions and western Europe, where it is a weed rather than a significant pasture plant. It was introduced by accident to Australia and its systematic cultivation was first undertaken in South Australia about 30 years ago. It is now extensively used for pasture and soil renovation purposes in Southern Australia and in New Zealand.

Description.—The plant is a hairy annual which produces prostrate stems and erect leaf stalks. Whitish flowers are produced in heads at the ends of short stalks and as the flowers mature many of the heads turn downwards into the ground and bury their seed pods.

Climatic Requirements.—Subterranean clover is a winter-growing plant and requires a fairly heavy late autumn and winter rainfall for its full development. The weather must also be moist and not too hot when the seeds are being formed, otherwise the flowers abort and the plant fails to seed itself down. A precipitation of 12 to 15 inches during the period May-October is required in most instances, and this is seldom realised in Queensland. In addition seasonal conditions in Queensland during August and September usually are unfavourable to seed development.

Soils.—Heavy soils are not favoured by subterranean clover. It prefers light soils of high fertility. In addition to its use for pasture purposes on good soils, subterranean clover is employed as a renovator of worn-out soils or as a pioneer pasture on naturally infertile soils.

Planting.—Seeds of various strains of subterranean clover are available on the market and farmers and graziers desirous of testing the clover under their local conditions are advised to experiment with early, mid-season and late-maturing strains. The seeds can be sown down on well-prepared land, either alone or in admixture with other pasture seeds, or they can be sown on renovated native or sown pastures.

A maximum seeding rate of 5 lb. per acre may be employed. It is essential to employ superphosphate with the seed if it is being sown on phosphate-deficient soils, and seed inoculation may be necessary.

Management.—The young plants should be permitted to develop some lateral branches before being grazed and stock should be removed at the time of seeding. There is some danger of hoven if grazing is not carefully controlled.

Conservation.—A hay of good quality is made from subterranean clover in the Southern States, the crop being cut when commencing to mature.

Feeding Value.—The clover provides, when green, a very luscious and nutritious feed for all classes of livestock and if allowed to cure naturally in the paddock retains much of its palatability and feeding value.

Pests.—The lucerne flea is very destructive of subterranean clover stands in some States, but does not occur in Queensland.

[TO BE CONTINUED.]

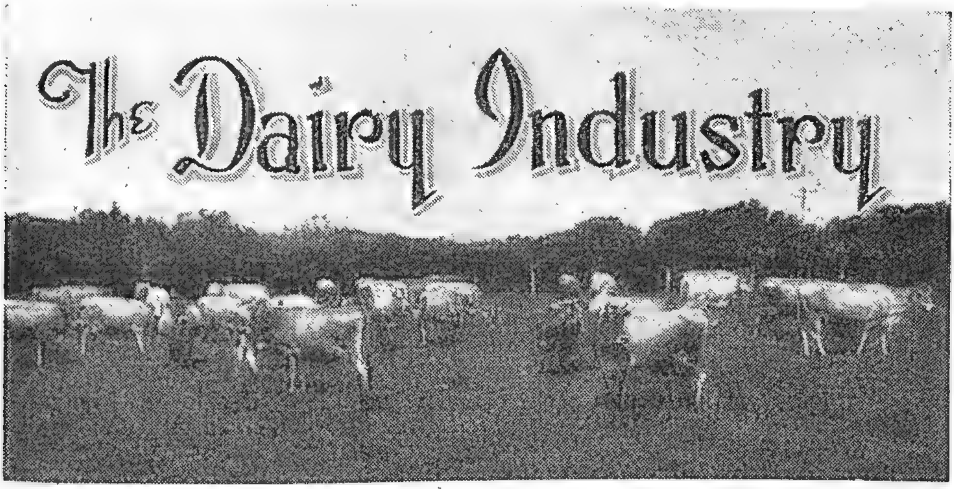
PLANTING OF GRASS CUTTINGS.

Grasses which are propagated commonly by means of stem cuttings, plantlets, or crown divisions, include Kikuyu grass, Para grass, couch grass, elephant grass, and Guinea grass. In special circumstances, the planting of vegetative material of the grasses mentioned may be carried out on rough country and on timbered land with some prospects of successful establishment; but, wherever possible, well-worked land should be provided.

Where stem cuttings are used, these should be cut with a knife, shears, or chaff-cutter into lengths, each containing at least two nodes or joints. If abundant material is available, it is advisable to allow several nodes to each cutting. The cuttings may be laid flat in shallow furrows and covered or placed vertically so that one or more nodes are buried and the remainder are above the surface. The soil should be well firmed about the cuttings. The cuttings shoot and root at the buried nodes and also form shoots at the other joints.

If plantlets or crown pieces are being planted, the best method is to set them out in holes in lines across the paddock. The holes are made with a hoe, the tool being used with its head at right angles to the line. When planting, the planter works along the line, places the plant against the hard far edge of the hole, fills up the hole, and compacts the soil with all his weight on his right foot, while putting in the next plant. To avoid setting the plants too deeply, the tuft should be held from above, but close to the crown, so that the knuckles of the hand are on top of the ground when the plant is being set.

—*C. W. Winders.*



To Cull or Not to Cull.

L. A. BURGESS, A.A.C.I., Dairy Research Laboratory.

TO cull or not to cull, that is the question which faces a dairy farmer after receiving the production records of his herd from the official herd tester. Against culling it has been argued that "the cows are only eating grass which costs the farmer nothing," and that other costs are equally inconsequential. Grass, however, is just as much an agricultural crop as wheat, maize, and sugar-cane. It is the crop on which the dairy farmer depends for his livelihood, and the cultivation of grass requires as much attention from him as other farmers give to cultivated crops. The cost of producing the grass crop is by no means small; it includes interest on the capital invested in land, stock, and equipment. The annual cost of pasture management must be added—including renovation of old pastures, fodder conservation, destruction of weeds and pests, the purchase of fertilizers to maintain the fertility of the pastures, cutivation of special fodder crops, and water conservation. Rates and other charges also add their quota to the cost of producing grass in sufficient quantity for the dairy herd.

The cost of milking includes interest on the capital invested in buildings and equipment. The cost of living of all persons engaged in milking must be added, no matter whether they are members of the farmer's family or not. If labour is employed, wages also must be taken into account.

The small amount of fat produced by some unprofitable cows in a herd certainly adds to the farmer's income, but unless the cream returns from them covers the working expenses involved such cows reduce the farmer's net income. As a profit of 5 per cent. is only a reasonable return from any investment, each cow should be required to give at least that rate of profit on her share of the capital invested. As an example of this reasoning the following hypothetical case is submitted:—

Total capital invested in the farm, stock, buildings, and equipment is £2,100; number of cows, 30; total working expenses for the year, £210.

		£ s. d.
Capital invested per cow	=	70 0 0
Working expenses per cow	=	7 0 0
5 per cent. profit on £70	=	3 10 0
Total return required per cow	=	10 10 0
Weight of fat (at 1s. lb.) to cover expenses	=	140 lb.
Weight of fat (at 1s. lb.) to cover profit	=	70 lb.
Minimum fat required from each cow	=	210 lb.

Cows producing less than 140 lb. of fat a year would not even be paying for their upkeep. As they would thus be responsible for a definite financial loss, they should be culled immediately and replaced either by young stock bred from the higher producing cows or by good cows purchased from a reliable source. Cows producing between 140 and 210 lb. of fat would be paying for their upkeep, but would not be returning the required 5 per cent. profit. They should be culled as opportunity offers of replacing them with better stock. The extra fat produced by the better stock would very soon compensate for any expenditure involved in the replacements, and thereafter would greatly increase the profit.

There is only one answer to the question at the head of this note, and that is: *Cull.*

QUALITY OF DAIRY PRODUCE.

The dairyman should always bear in mind the fact that butter and cheese can be only as good as the milk from which they are manufactured. If milk of an inferior quality is produced, the butter or cheese factory cannot be expected to manufacture a first-class article.

Milk is the normal secretion obtained from the udder of a healthy cow, properly fed and cared for. Milk obtained during fifteen days immediately prior to, and ten days immediately following, calving, should be excluded from the bulk supplies. Milk should contain not less than 3.3 per cent. of milk fat, and must be free from any added water, separated milk, or preservatives.

Milk from cows suffering from mastitis, or any other disease of the udder, should not be used.

Cows should not be allowed to wade in or have access to stagnant water. The flanks should be brushed with a cloth, when the animals come into the bails. Clean water and clean cloths should be used for the purpose of washing the udders and teats prior to milking, and the hands of the milkers should be washed before, and again after, milking each cow.

The first few drops of milk are usually contaminated and, therefore, should be milked into a tin and thrown away after milking. They should not be milked on to the ground, or thrown about the bails where they are liable to attract flies.

Musty feed must not be fed to cows. The animals should not be allowed to graze in paddocks known to contain weeds which will impart a detrimental flavour to milk, nor should they be fed highly flavoured foods immediately before or at the time of milking.

Dairy utensils should be thoroughly cleansed and scalded, then aired and dried in the sun in an inverted position.

Disinfectants, under normal conditions, should not be used in the dairy house or bails.

—*D. A. Logan.*

Hot Weather Ailments in Pigs.

E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

AS is well known, pigs can stand ordinary extremes of temperature if they are in health; but there are times and occasions when hot weather beats them, especially if they are forced against their will to travel.

Sunstroke and heat apoplexy are ailments which are aggravated by the exposure of the animal to the actual rays of the sun, by over-exertion, and by thirst.

Pigs running in paddocks, and kept ordinarily under open air conditions, are rarely overcome by the effects of heat so long as they are provided with reasonably cool shade; but they cannot stand up to exposure in bare yards where there is no protection and no relief from the heat.

Breeding stock, both boars and sows, of mature age, usually can be relied on to look after themselves and keep out of the sun when it becomes very hot; but young pigs sometimes lie too long in the sun and, as a consequence, suffer severely from sunburn and scald.

These skin ailments are caused by the effects of the sun on the tender, somewhat unprotected skin of the pig.

Treatment for sunscald or sunburn must be preventive as well as curative. The pigs should be housed in clean, comfortable, well-protected sties, or in a well-shaded grassy yard or paddock. If the animals show soreness and are in need of treatment, they should be treated so as to cleanse and heal the skin, and should thereafter be kept under better conditions. The old-time remedy, kerosene and fat, although crude and sometimes effective, is not a reliable skin ointment. Spraying with crude oil or sump oil is usually preferred.

During and after treatment, the pigs should be given sound, nourishing foods, plenty of greenstuff, clean drinking water and essential minerals. Shade trees—such as weeping willow, pepperina, native figs, and phytolaccas—or upright growing shrubs like Buddleia—are recommended. Where skin trouble in pigs is aggravated by the presence of parasites like lice, sandflies, mosquitoes, fleas, or flies, the hair will also become affected. There may be a scurfiness of the skin indicating an unhealthy condition and a deep subcutaneous penetration of the burn or scald. In very severe cases, partial paralysis and a rickety condition may become evident. The animal suffers great pain, and may even lose the use of its hindquarters, particularly in the case of young pigs weakened by improper care and unbalanced rations.

Any animal showing signs of illness during hot weather should be immediately isolated and given proper treatment. In addition to skin treatment, affected animals should be fed on very light nourishing foods. Occasional doses of epsom salts will also be beneficial, and may be administered in the food.

Sunscald, sunstroke, heat-stroke and heat apoplexy are similar in their effect on the animals; sunstroke is due to exposure to the direct rays of the sun; heat-stroke is due to intense heat, even though the animal may be protected from the direct sun rays; heat apoplexy follows exposure and exhaustion during hot weather.

In each case very fat animals suffer most, especially if they are exercised too freely or are compelled to travel during the heat of the day, or are forced along too rapidly during muggy weather. Exposure to heat, even without exercise, is dangerous. Many valuable pigs have been lost through being shut up in hot, dry yards without any shade, water, or protection from the heat.

It is unwise to overfatten pigs in hot climates—it also is uneconomical, especially as no payable demand exists for fat pork or bacon. It is equally disastrous to keep breeding and growing pigs in an overfat condition. Pigs in sties may suffer very greatly from heat, because of bad ventilation, or unsuitable accommodation.

Many pigs die of heat apoplexy en route to market or factory. In some cases the animals are overheated before being trucked, and this, together with consequent excitement and fatigue and the absence of cool drinking water, leads to fatal results. To pen pigs in comparatively cool, shady pens, and then suddenly expose them to heat and severe exercise during a journey is to invite trouble. An overheated pig will lie down and lose control of its movements. The first indication is usually an unsteady gait and dullness. The pig may show no other indication of illness, but may just fall over and become unconscious.

In these cases, the animal's breathing is usually much more laboured than normal, even though it may appear very faint. The ears are invariably hot and droop loosely. The eyes are dull and the nose is hot and dry. The animal appears to lose control of its movements; the head hangs limply and the body sways to and fro. As the trouble advances, trembling of the muscles, followed by convulsions, may also be observed. The bodily temperature increases and the animal gasps for breath. The course of this disease may be very short and the animal may die in a few minutes after the illness first manifests itself.

In other cases—as when animals are loaded into pig wagons in an overheated condition—the pigs may live for several hours.

A good clean water bath in some convenient shady place is an excellent thing for pigs in hot weather. If provision can be made to enable the pigs to cool off for an hour or two before trucking, and for a good water supply, many valuable animals may be saved. A properly constructed concrete wallow or bath is preferable to a mud bath.

One sometimes notices a farmer carting his pigs on a hot day in a small cart or wagon quite unprotected except for a few green bushes over a wire netting frame work. The provision of a suitable cover for pigs, such as would allow for a current of cool air and protection from the sun, would soon repay its cost, and add considerably to the comfort and satisfactory transit of the pigs. If trucking must be done in very hot weather, the pigs should be delivered to the station early in the morning, and should be allowed time to cool off. They should, of course, have ample drinking water before starting on the road.

If treatment is necessary the animal should be placed in the shade and cold water or a cold water pack (wet bagging) be applied to the snout, face, and then the head. The treatment must be persisted in for several hours in severe cases, after which the animal should be compelled to take light exercise.

A change to a very light nourishing diet is advised when once the animal has been placed in a suitable pen or yard with plenty of shade and protection, as it will take affected animals several weeks to get back to normal again. No attempt should be made to send them to the factory until they have quite recovered from the attack.

BRANDING OF PIGS.

Under the Queensland Pig Industry Act, the identification of all pigs sold, offered for sale, barter, or exchange, is compulsory. This is essential to satisfactory marketing of this class of stock, and where marking is carried out as a regular routine job, presents little difficulty. Identification facilitates investigation into disease, whether epidemic or otherwise.

The Act provides particularly for the marking of all pigs consigned to factories, and there has been widespread appreciation of its value. There may be differences of opinion in regard to the advantages of various systems of identification; but from a factory point of view it is a very great advantage to have the carcases plainly identified..

Exporters prefer the body tattoo as a means of identification, and bacon-curers almost without exception are more than satisfied if the carcases are tattooed efficiently. The use of the firebrand is being superseded generally by the more efficient method of tattooing, in which a body-tattooing instrument and marking paste or ink are used.

The marking of sucker, weaner, and store pigs presents greater difficulty, because neither the body tatoo nor the firebrand are sufficiently permanent where the pigs are to be retained on the farm for periods varying from two to five months. In the case of these young pigs, two systems are especially adaptable viz., earmarking and ear-tattooing, the latter being suitable only in the case of white or red coloured pigs.

The departmental pamphlet, "Identification of Pigs," is available free on application to the Department of Agriculture and Stock, Brisbane.

Possible Substitutes for Lead Arsenate in the Control of Codling Moth.

HUBERT JARVIS, Research Officer.

FOR a considerable time lead arsenate has been the most widely used insecticide for the control of the codling moth in deciduous orchards. ;Although reasonably effective, a spray schedule based on lead arsenate has some disadvantages; residues greater than the tolerance limits permitted may accumulate on the fruit, and the vigour of the trees may be affected adversely. A considerable amount of attention has therefore been given to the study of non-arsenical substitutes during recent years.

Experiments at Stanthorpe during the 1935-36 season indicated that a number of possible substitutes, including potash soft soap, colloidal sulphur—potash soft soap, nicotine sulphate—white oil and colloidal sulphur—nicotine sulphate may be just as effective as lead arsenate for the control of codling moth. With the exception of potash soft soap, spraying costs are much higher, and it is improbable that these sprays will, in practice, replace lead arsenate for specifically codling moth control purposes. Potash soft soap, however, compared favourably with lead arsenate in both efficiency and costs, and some comments on this insecticide are therefore necessary.

Potash soft soap is readily prepared, and at the experimental strength of 10 lb. to 80 gallons of water has no harmful effects on the trees. Colloidal sulphur can be added when necessary to form a combined spray which should control not only the codling moth, but also powdery mildew which is frequently troublesome. Experimental trees were free from "scorch," which so often appears in orchards treated with lead arsenate—particularly during the harvesting period.

Potash soft soap may therefore be of some value, but a great deal more work is necessary before the grower can regard it as a reliable

substitute for lead arsenate. Experimental results always require confirmation on a large scale before any existing practices can be safely modified. The current year's experiments at Stanthorpe are accordingly designed to check the accuracy of the results already available, as well as to investigate the insecticidal properties of potash soft soap in detail. The practicability of timing spray applications more accurately by observations on moth activity will also be studied. Alterations of standard practices may or may not then be advocated.

In the meantime, orchardists may wish to use a little potash soft soap on their own trees during the coming year for personal observations. Under these conditions, a small group of trees may be given the complete potash soft soap schedule, adding colloidal sulphur when necessary for the control of powdery mildew, the balance of the orchard receiving the customary treatment. If the moths are very numerous, growers should adhere strictly to the ordinary spray programme on the orchard, rather than risk losses by using an alternative spray, such as potash soft soap, the value of which requires further investigation.

THE PLANTING OF BANANAS.

The best aspect for banana-growing is one varying from easterly to northerly, and even north-westerly, provided that the plantation is well sheltered from strong winds. As southerly slopes are usually cold, banana plants, if grown on them, develop slowly, and the fruit is generally inferior—hence land with a southerly aspect is not worth considering if other land is available.

Logging and hoeing operations should, if possible, be followed by a thorough grubbing. Grubbing is particularly advisable if the plantation is being established in forest soil. It is necessary for the aeration and drainage of the soil, and the maintenance of a supply of moisture for the plants. Many growers look askance at forest soils for bananas, but plantations on such soils, if worked thoroughly and desuckered carefully, can produce fruit of first-class size and quality.

As a result of the recent rains, it is now possible to plant bananas in many localities in which, hitherto, the protracted dry weather had been against a successful setting. If bits or butts are being utilised, careful attention must be paid to baiting for the banana weevil borer to ensure the planting of clean material. Growers in need of advice on the selection and preparation of planting material should get in touch with the nearest fruit inspector or banana agent.

Holes for planting should be, roughly, about 15 inches square by 15 inches deep. The surface soil from the top side should be raked back into the hole and the sucker placed in the loose soil and tramped firmly all round. The top of the sucker need only be covered lightly with loose earth, and the hole should not be refilled completely.

An application of about ¼ lb. of fertilizer when planting will hasten and strengthen the growth of the young plants. The actual time of planting will depend on the conditions in the different districts. On a slow-growing aspect, October planting is best, while on warmer slopes November and December may be more suitable.

Where grubbing has not been done previously a circle around each plant with a radius of approximately 3 feet should be grubbed. This gives the plant both sufficient sunlight and freedom from smothering weeds. Planting 10 feet by 10 feet is a good average distance, but 12 feet by 12 feet is preferred by many growers.

The best method of spacing followers is that known as "one bunch one follower." This enables the grower to regulate and handle his fruit cutting and packing with convenience, as it is more or less confined to the winter months. For about the first twelve months after planting, all but one or two followers should be kept back, and thus all energy is directed into one plant and its bunch. The folly of allowing as many suckers as may appear to develop cannot be condemned too strongly.

—*J. Freeman.*

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

NEW season's cherries, apricots, and China Flat peaches are on sale, heralding the early approach of all types of stone fruits.

The following were the prevailing prices at the end of October:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Nines, 18s. to 19s. 6d. per case; eights, 13s. to 18s. 6d.; sevens, 11s. to 18s.; sixes, 9s. to 15s.; smalls, 6s. to 14s.; Lady Fingers, 4½d. to 11d. per dozen.

Sydney.—Eights and nines, 22s. to 25s. per case; sevens, 18s. to 22s.; sixes, 15s. to 18s.

Melbourne.—Nines, to 22s. per case; eights, to 20s.; sevens, 18s. to 20s.; sixes, 16s. to 17s.

Adelaide.—23s. to 24s. per case.

Pineapples.

Brisbane.—Smooths, 6s. to 8s. 6d. per case; 2s. to 8s. per dozen. Ripleys, 9s. to 11s. per case; 1s. 6d. to 7s. per dozen.

Sydney.—Smooths, 9s. to 12s. per case.

Melbourne.—Smooths, 8s. to 12s., with some specials up to 14s., per case.

Adelaide.—16s. to 17s.

Papaws.

Brisbane.—Yarwun, 7s. to 10s. a tropical case; Local, 4s. to 5s. a bushel case; Gunalda, 5s. to 6s. a bushel case; inferior lines lower.

Sydney.—9s. to 12s. a tropical case.

Some lines are arriving specky, and it would be to their advantage for a better selection of firm types to be used.

Melbourne.—10s. to 14s. a tropical case.

Mangoes.

Brisbane.—Well-packed lines, 7s. to 8s. per bushel case; bruised lines lower and hard of sale.

Sydney and Melbourne.—Only good types of mangoes should be sent to these markets.

Passion Fruit.

Brisbane.—First grade, 10s. to 13s. per half-bushel; second, 6s. to 9s.

Sydney.—7s. to 10s. per half-bushel.

Melbourne.—9s. to 18s. half-bushel.

Strawberries.

The present crop is now practically finished. Few first-grade berries are now to be seen. The advent of new season's stone fruits will decrease the demand for strawberries; so only first-grade fruit should now be marketed.

CITRUS FRUITS.

Oranges.

Brisbane.—6s. to 8s. per case; specials, 9s. to 10s. 6d. per case; second crop, 3s. to 5s.

Second-crop fruit is extremely hard of sale, only well-coloured lines being saleable.

Sydney.—Valencias, 5s. to 8s. per bushel.

Melbourne.—Navels, 4s. to 9s. per bushel; Valencias, 4s. to 9s.

Grape Fruit.

Brisbane.—4s. to 9s. per bushel.

Sydney.—4s. to 10s. per bushel.

Melbourne.—7s. to 16s. per bushel.

Lemons.

Brisbane.—Gayndah, 6s. to 12s. per bushel; Benyenda, 14s. to 15s.; locals, 3s. to 8s.

Sydney.—2s. to 5s. per bushel.

Melbourne.—4s. to 8s. per bushel.

OTHER FRUITS.

Apples.

Brisbane.—Jonathan, 6s. to 10s. per case; Granny Smith, 5s. to 9s.; Sturmer, 4s. to 7s.; Crabs, 6s. to 7s.; Delicious, 9s. to 10s. 6d.; Democrat, 5s. to 8s.; Crofton, 7s. to 10s.; Yates, 5s. to 9s.

With the exception of Yates variety, all others are giving a lot of trouble in becoming specky. Only selected fruit should now be sent to Brisbane.

Pears.

Brisbane.—Coles, 10s. to 13s.; specials to 16s.; Winter Nelis, 9s. to 15s.; Josephine, 10s. to 15.

Some lines specky and hard of sale.

Cherries.

Brisbane.—7s. to 10s. a 12-lb. box; specials higher.

China Flat Peaches.

Brisbane.—2s. to 4s. per tray.

Cape Gooseberries.

Brisbane.—6d. to 6½d. per lb.

Tomatoes.

Brisbane.—Ripe, 1s. to 3s. half-bushel; green, 2s. to 3s.; coloured, 3s. to 4s. 6d.; specials higher.

Sydney.—Queensland tomatoes, 2s. to 5s. per half-bushel.

Melbourne.—Adelaide hothouse, to 18s.; Western Australian, 6s. to 14s.

VEGETABLES.

Beans.

Brisbane.—5s. to 6s. sugar-bag.

Melbourne.—To 16s. per 50-lb. bag.

Peas.

Brisbane.—5s. to 6s. bag.

Lettuce.

Brisbane.—1s. to 2s. per doz.

Cucumbers.

Brisbane.—3s. to 5s. a bushel.

Sydney.—6s. 6d. to 10s. a bushel.

Melbourne.—5s. to 7s. a bushel.

PUBLICATIONS.

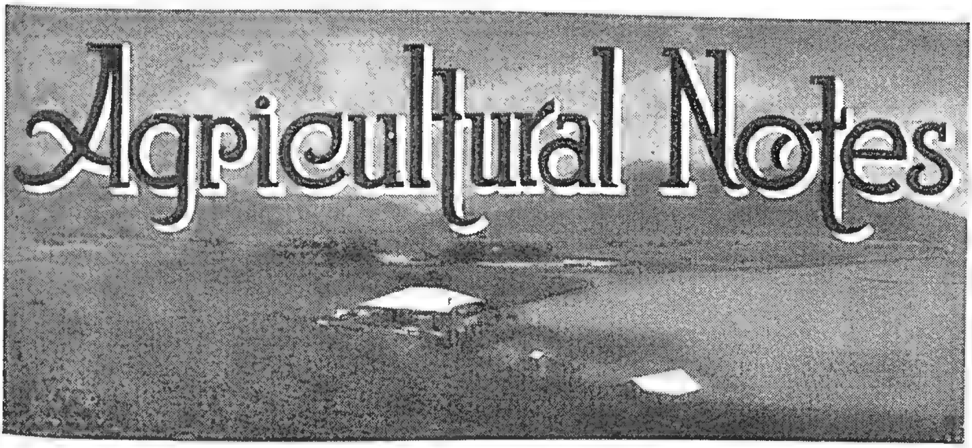
"Strawberry Packing," "Passion Fruit Marketing," and "Peach Packing" are now available for distribution. "Tomato Packing" is now in the hands of the printer, and should be available for distribution later in the month.

SOWING TOBACCO SEED.

Owing to its minute size, special care has to be taken in the sowing of tobacco seed. The method followed most generally is to mix it with some solid distributing medium, such as wood-ashes, and to apply the mixture to the prepared seed-bed.

Another method, which has much to commend it, is to apply a suspension of tobacco seed and water to the bed by means of a watering can. Advantages claimed for this method are that the process of mixing the seed with the distributing medium is quicker and less troublesome than the other method, and furthermore it can be used in windy weather quite satisfactorily. The momentum of the falling drops furthermore tends to partly embed the seed in the soil.

The procedure for watering-in is as follows:—Half fill a watering can with water, measure out the requisite quantity of seed, and mix thoroughly with the water, then pour in the rest of the water to nearly fill the can, and again stir. It will be seen that the seed remains in suspension, evenly distributed throughout the volume of water. The water then should be quickly and evenly distributed over the surface of the bed. This is easier if the surface crust of the bed is dry, when the ground covered can be the more readily distinguished.



First Steps in Irrigation Practice.

H. W. KERR.*

INTRODUCTION.

IT is pleasing to record the sustained interest in the value of irrigation practice, as an aid to reduced production costs; this is evident in most cane areas of Queensland, with the exception of the humid belt from Tully to Babinda. Doubtless irrigation is also the greatest single force capable of conferring stability and certainty in those areas where rainfall deficiency and distribution are the major factors in limiting acreage yields. The best example of what may be achieved by wide-scale irrigation is the Lower Burdekin area. During recent years great strides have been made in the more economical application of water and the judicious use of appropriate manures; the result has been to raise the average sugar yield per acre, over the three mill areas, to almost 5 tons of sugar per acre.

In response to numerous requests, the following notes have been prepared to serve as a guide to those farmers who, with limited funds, are desirous of searching for and developing water resources chiefly through their personal efforts, so as to minimise costs of investigations and installation. It is hoped that the relevant data provided may prove useful, though it should be stressed that these notes are necessarily general in character, and specific advice should be requested where any special features are involved.

WATER SUPPLY.

The first consideration is, of course, the availability of adequate, good-quality water. This may be obtained from either open streams or subterranean sources. In point of fact, there is essentially no difference between these seemingly widely separated sources. In each case a stream of water is involved; whereas the former is flowing in an existing "natural" water course, the subterranean stream actually follows a pre-existing course which has since become overlaid by sediments or other deposits so that its existence is no longer obvious, but along which

* In the "Cane Growers' Quarterly Bulletin" (Bureau of Sugar Experiment Stations, Queensland) for October, 1937.

underground streams are still able to flow. The major difference is, of course, that careful search is required to locate the latter; but it is rather significant that Queensland practice demonstrates a generally greater degree of reliability and permanence than can be claimed for open streams, notably in the drier areas of the State.

Plate 244.
Delivery of water from flume to main ditch.

The location of underground water is a subject for controversy which revolves around the claims advanced in support of some occult power, alleged to be possessed by certain individuals, in detecting the existence of subterranean water—so-called "divining." The writer has no desire to become involved in any discussion on this topic, and doubtless nothing that might be advanced for or against would influence farmers in their attitude towards the diviner and his work. Suffice it to say that the location of probable sites at which water-bearing strata will be encountered is largely a matter of "hit and miss" methods. Where any extensive borings have been made in an area, it is possible to formulate general principles which will indicate whether the site selected offers prospects of success. The only sure method of testing any probable site is by boring. In soft strata, the use of a posthole digger, and later, the sand pump, may enable a bore to be driven in a fairly simple and rapid manner. But where compact rock strata are encountered, the use of a boring outfit is necessary. Naturally the cost of boring will be governed by the nature of the strata and the depth at which water is encountered.

QUALITY OF WATER.

One of the first considerations, when a water supply is located, is to determine the quality of the water. It is always desirable to have a test made by a competent analyst, whether the water be drawn from an open stream or an underground supply. For this purpose, a representative sample of about a pint should be transferred to a clean bottle, and despatched to the nearest Sugar Experiment Station, or the Head Office of the Bureau, where an analysis will be made and an opinion given free of charge to all canegrowers. With subterranean supplies,

the sample should be taken after pumping for a time to assure that the sample is truly typical of the supply and is not the result of surface seepage.

Many natural waters are too salty for irrigation purposes, while others contain harmful amounts of substances such as carbonate of soda, which act as "poisons" to crops. This simple precaution of chemical test is always worthwhile, and might save much worthless expenditure on plant and installation. The limiting concentrations of undesirable salts cannot be formulated without reference to the soil type on which the water will be used, and to the presence or absence of other compounds in the water, which may act as correctives.

TESTING CAPACITY OF SUPPLY.

It is next important to determine the capacity of the available supply. Where an open stream is to be drawn on, this is a relatively simple matter. For large streams, records are generally available, from gaugings, and these will indicate the capacity of the river or creek with the necessary degree of accuracy. It is well recognised that open streams vary in flow, being usually at a minimum in the spring and early summer months. As it is at this season of the year that the greatest demands are made by the cane crops, the farmer should assure himself that the flow (or flow plus possible storage) is capable of supplying the full demands of the plant which he proposes to install. This is especially important with creeks of limited capacity. For such streams it may be necessary to arrange for a measuring weir to be installed, and careful and systematic flow records kept. To provide some idea of the flow required to supply the needs of centrifugal pumps of varying size, the following table is presented as a useful guide:—

Diameter of Pump. Inches.	Capacity per hour. Gallons.
3	9,000
4	16,000
5	24,000
6	33,000
7	45,000

Where the minimum flow does not permit of the desired pump size, the possibilities of damming the stream to provide night storage for daylight pumping, should be carefully investigated. It should be noted that, before a farmer is permitted to draw on open streams for irrigation purposes, application must first be made to the Department of Irrigation and Water Supply, which will advise him of the formalities to be complied with.

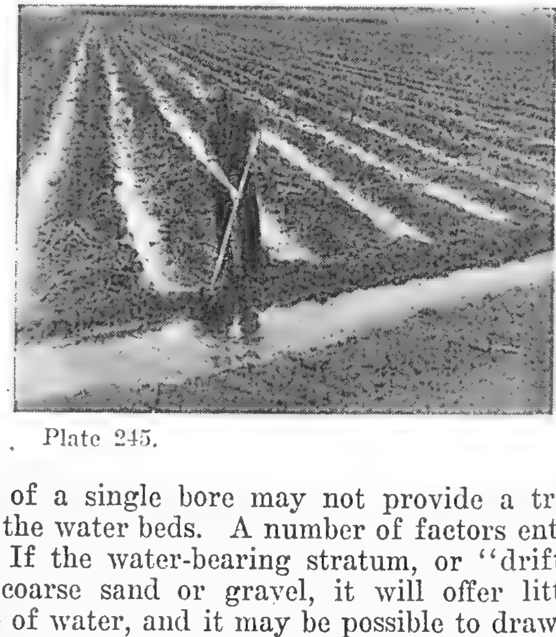
As a guide to the number of acres which might be watered satisfactorily with a given supply, it is safe to assume that this will be equal to the number of thousands of gallons which the pump will deliver per hour. Thus, for a 7 inch pump delivering 45,000 gallons per hour, an area of 45 acres may be watered adequately, when the pump is operated for ten hours per day, approximately 100 days per year.

The testing of underground supplies is not so simple. Some indication may be gained by a pumping test on a bore which has been driven into the water-bearing stratum. When boring, it is customary to operate the auger, sand pump, etc., inside a steel casing somewhat

larger in cross sectional area than the tool which is employed. By applying weights or force to the casing, it is driven downwards as the soil or sand is removed from within. Successive lengths of casing are attached to enable it to extend to the water-bearing stratum; for preference, the casing should be lowered to the *bottom* of this layer. For the pumping test, a "spear" attached to a suitable suction pipe is then lowered within the casing, and attached to a pump. The spear consists of a cylinder of gauze which serves to admit the water while excluding the sand. Modern spears are now manufactured as variations of the earlier type, but they perform essentially the same task with greater or less efficiency.

The nature of the test pumping unit is a matter for consideration. A centrifugal or other form of suction pump cannot be operated unless located at not more than 25 feet above the water level; the level will, of course, also be lowered during the progress of the trial.

Main or feeder ditch.



Furrow irrigation from main ditch.

Plate 245.

Naturally, the capacity of a single bore may not provide a true reflex of the full capacity of the water beds. A number of factors enter to complicate the problem. If the water-bearing stratum, or "drift" as it is called, is of very coarse sand or gravel, it will offer little resistance to the free passage of water, and it may be possible to draw a large supply from a single bore. On the other hand, a fine sand drift may yield water at a relatively slow rate, yet with a series of spears, each suitably located, and jointed to one central suction pipe, it may supply over 100,000 gallons of water per hour. These questions require

careful study and test in order that the true capabilities of the site may be gauged. Of course, expert advice is very helpful and necessary in reaching a reliable conclusion in these matters.

SELECTION AND INSTALLATION OF PUMPING UNIT.

Having established the existence of an ample and accessible water supply, the next considerations are what it will cost to deliver water to the field, and what will be the most economical unit to install for pumping; the latter question involves (*a*) cost of installation, and (*b*) operating and maintenance cost.

The cost of pumping will be directly related to the height to which the water must be raised. Thus it will require four times the power to raise a given quantity of water 100 feet, as it will to raise it 25 feet. To determine the total "head," as it is called, one must determine the difference in height between the water in the drift, *when the pump is operating,* and the point of emergence of the water from the delivery pipe. In addition, it is necessary to make allowance for the friction loss due to the passage of water through the spears and pipe line. It is customary to provide a suction and delivery pipe about 1 inch greater in diameter than the intake and outlet of the pump respectively, to avoid any serious loss from the lastnamed cause. However, if water must be raised a considerable height through heavy gauge piping, the increased diameter may add appreciably to the installation cost. The friction loss at the spear will be governed by the type of drift.

Plate 246.

Illustrating tube method of delivery of water from feeder ditch to furrows. The flow of water may be controlled by adjusting the level of the galvanised iron tubes.

When the total head against which the pump must operate is known, it is possible to calculate the approximate engine power necessary to take care of the desired volume of water. This figure will naturally be governed by the efficiency of the pump. Though the modern centrifugal pump has been developed to a high state of efficiency, it is most important that the speed at which it is operated be carefully checked to ensure the maximum pumping efficiency. That is to say, there is definite speed at which the pump will deliver water at a

minimum cost per gallon; for speeds above or below this figure, the *actual* water delivery will be raised or lowered, but at the same time the cost per gallon will be invariably increased. The best speed will also depend upon the pumping head, and the guidance of a reputable irrigation supply firm should be sought in the selection of the most suitable unit for a given job.

Wherever practicable, it is desirable to install a horizontal centrifugal pump, operated by belt drive from the engine. As was indicated earlier, the pump must not be more than 25 feet above the level of the water, or it will not draw its supply. For preference, the pump should be placed as close as possible to the water bed. Where the water-bearing drift is, say, 30 feet below the land surface, a pit or well may be scouped or dug to a suitable depth, and the pump installed therein. The engine may then be placed at normal land level.

For deep supplies, the vertical spindle centrifugal pump becomes necessary. As the excessively long shafting required for this purpose demands adequate bearings, to assure true running, the heavy channel iron supporting frame for such a layout adds considerably to the installation cost. However, it is essential for efficient working with deep supplies of underground water.

A so-called "one-stage" centrifugal pump is satisfactory provided the total pumping head does not exceed, say, 100 feet. With greater heads, the efficiency of the pump falls off at such a rapid rate that a two- or three-stage unit should be employed. Naturally, this will increase the installation cost to some extent, but it makes for reduced costs of operation.

To provide some indication of the manner in which the pumping costs per million gallons of water will vary with variation in the pumping head, the following examples are given. In each case a pump supplying 50,000 gallons of water is stipulated:—

Overall Head.	Nature of Pump.	Pump Speed.	Engine Power Required.
Feet.		Revolutions per Minute.	Horse Power.
25	Single stage-low head	1,230	11·5 net.
50	Single stage-low head	1,480	19·0 net.
100	Single stage-high head	1,550	38·0 net.
200	Two stage-high head	1,550	76·0 net.

In making these calculations, allowance has *not* been made for the power transmission loss, which is often very considerable with an inefficient belt drive. Direct coupling of the pump to engine eliminates this loss, but is seldom practicable.

The selection of a suitable power unit offers considerable scope. Four types are commonly employed—(*a*) steam, (*b*) suction gas, (*c*) internal combustion oil engine, or (*d*) electric motor. The older units were almost all steam operated; then came the era of the suction gas engine, where an abundance of suitable firewood was available. More recently petrol and kerosene internal combustion engines were introduced, while the latest types are almost exclusively so-called "diesel" engines, which

operate on crude oil. The last-named type has practically superseded all others. Occasionally, electrical power is employed, either from general service mains or from a central installation employing, say, crude oil or coal to generate electricity, which may be used to operate at will any or all of a number of pumps suitably located over the area to be watered.

It is reasonable to dismiss consideration of steam units in laying down a modern plant. Suction gas may warrant attention in particularly favourable circumstances, but, like steam, it demands the continuous attendance of an operator, which adds substantially to pumping costs.

The internal combustion oil engine—and notably the crude oil type—does not suffer from this handicap. While it must not be assumed that an engine of this class may be allowed to run unattended, it is true that intermittent supervision only is demanded, and the operator may devote attention to other duties as well. At the present cost of crude oil, and with the high efficiency of this type of engine, a maximum fuel cost of $\frac{1}{3}$d. per horse power per hour may be assumed.

The power of the engine required must also be considered carefully. While it is obviously unwise to attempt to overload the engine, it is not good business to over-capitalise the plant by installing an unduly high-powered unit. Expert advice is most helpful in arriving at a satisfactory decision; however, the following formula will provide the farmer with a fair estimate of power of a suitable engine, making due allowance for transmission and friction losses and overload margin:—

$$\text{H.P. required} = \frac{\text{Total head (suction, delivery and friction), in feet} \times \text{gallons of water per hour.}}{100{,}000}$$

That is, multiply the vertical distance in feet, from the water-level to the highest point of the delivery pipe, plus an allowance for friction losses, by the estimated volume of water the pump will deliver hourly, and divided by 100,000.

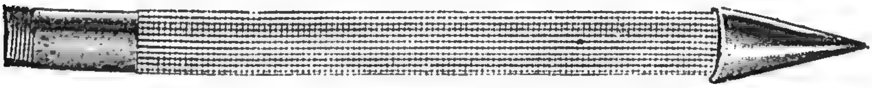


Plate 247.
An irrigation spear.

It has already been observed that the pump speed is very important, and care must be taken to select suitably sized belt pulleys for engine and pump to give the desired revolutions.

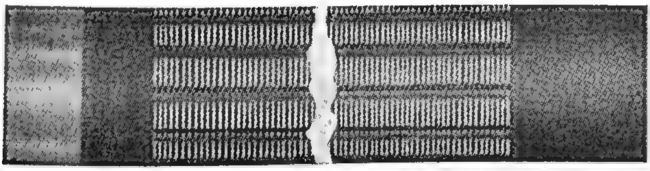


Plate 248.
New type of slotted spear.

Where water is drawn from an open supply, it is only necessary to provide that the suction opening has access to an adequate depth of sand-free water, and to assure that it is not drawing air. Where an underground drift is tapped, care must be taken to ensure complete separation of all sand or gravel from the water entering the pump. The selection of suitable parts for the spear system is therefore of importance. It is found that, where the drift is of medium or fine sand, the rate of passage of water to the spear is relatively slow, and it is then desirable to connect a number of 3-inch spears to a common suction pump. With coarse sand or gravelly drift, fewer large-sized spears (6 inches) are a distinct advantage; they are simpler to install and also

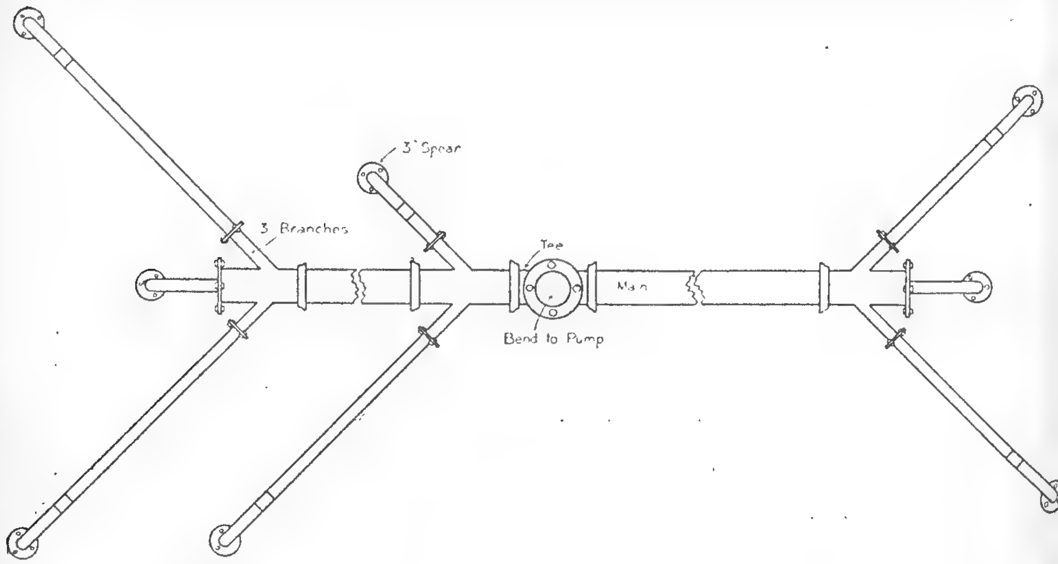


Plate 249.
Typical arrangement of a spear system.

less costly and troublesome to maintain. The accompanying illustration indicates the manner in which the spear system is spread out, to assure that a volume of drift is tapped, adequate for the full water requirements of the pump. Though there is nothing particularly difficult in installing a spear system, there are certain well recognised principles which must be observed for successful operation, and the grower would be well advised to seek expert guidance in this regard.

Wells are sometimes employed to provide the source of supply to the pump. In general, these do not have a high capacity unless combined with a spear system radiating outwards from the bottom of the well. However, it is frequently possible to obtain at least a 4-inch pump supply from open water in this way; such a unit is working successfully at the Mackay Sugar Experiment Station. The dry, upper portion of this well is lined with corrugated galvanised iron, in the form of a cylinder; when the water-bearing stratum was encountered, a brick lining was employed, and this was built up as the water-bearing sand was removed and the brick ring subsided. During the sinking of a well of this nature it is necessary to pump out the water at the same rate as that at which it enters; a centrifugal pump, the speed of which can be varied as required is desirable in this connection.

ECONOMICS OF PUMPING.

The grower will naturally be highly interested in determining what expenditure it is economical to incur in delivering the water to his crop. Over-all costs (allowing fully for interest and redemption on the installation and maintenance and running costs) vary very considerably. In certain favoured areas water may be obtained for a total cost as low as 22s. 6d. per million gallons. In general, it will be considerably higher.

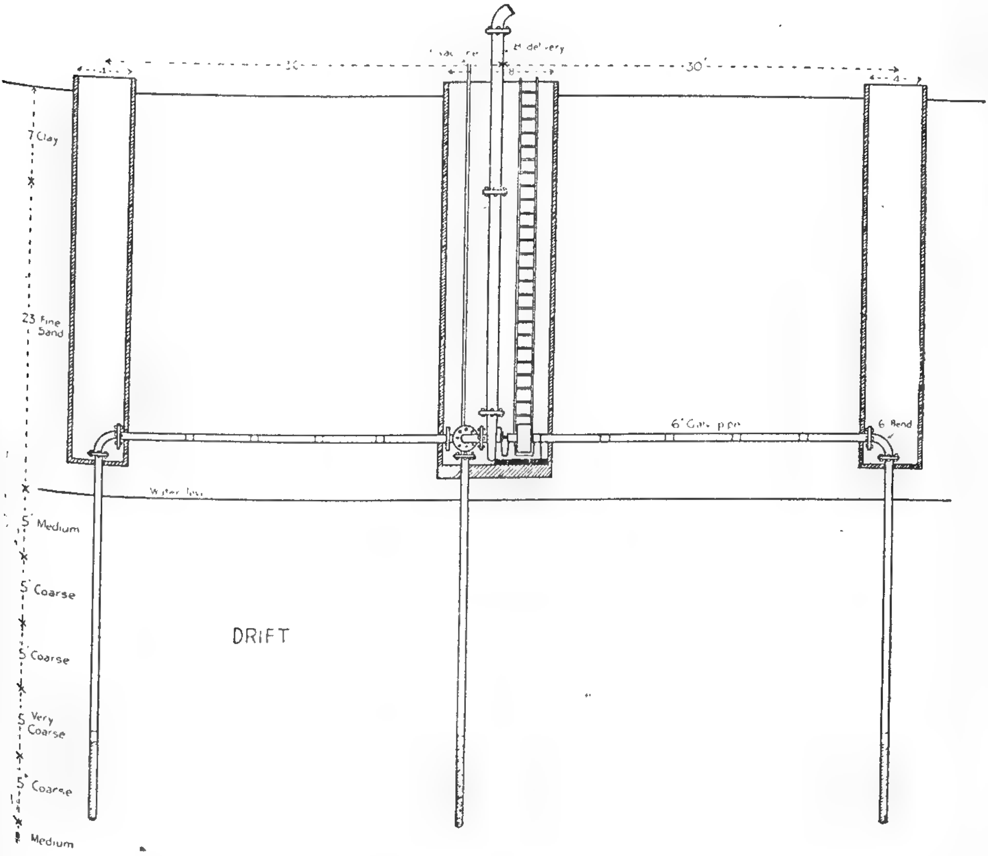


Plate 250.
Illustrating use of concrete lined wells for deep spear installations.

The farmer may take it as a safe guide that, provided he is able to finance the layout, water costs not exceeding £5 per million gallons will prove highly economical, particularly in the drier areas of the State.

FEEDING OF CONCENTRATES.

Farmers are often averse from feeding concentrates, which impart a flavour or "taint" to the butterfat. Peanut products are a typical example. In many cases the difficulty may be overcome by feeding the material immediately after milking. The animal then is assured of sufficient time, before the next milking, in which it can utilise the constituents which give the off flavour.

The Growing of Cowpeas.

L. HODGE, Biloela Research Station.

THE cowpea should undoubtedly be grown much more extensively—as a cash crop for seed, a grazing crop for stock, and for green manure —by Central Queensland farmers than it is at present.

It is a summer annual related more closely to the bean than the pea, and while it thrives best under warm, moist, conditions, it grows satisfactorily in the inland agricultural districts and during dry weather, provided that it is warm enough. In addition, this accommodating plant does well on poor soils and is thus useful for enriching them, as it is a supplier of nitrogen.

Cowpeas should be sown from mid-November to mid-December to get the best results. The rates of sowing are very elastic, depending on the nature of the soil, the rainfall, and the purpose for which the crop is required. The sowing may vary from 10 to 12 lb. of seed to the acre, according to variety.

If grown for seed, it is recommended that it be planted in rows 2 feet 3 inches apart at a rate of 12 to 14 lb. to the acre, and from 2 to 2½ inches deep. Seed yields of from 15 to 20 bushels an acre may be obtained under moderately good conditions. The seed can be either harvested and sold—it usually commands a good price (15s. to 20s. per bushel)—or fed in the field to pigs, in conjunction with other foods. A variety grown for seed should be one of the kinds which have been especially developed for seed production, as against vine production. The black cowpea is a good type, but others—such as Poona, Groit, and Brabham—are now gaining favour.

The cowpea is an excellent crop for grazing, especially for soils and districts where lucerne does not flourish. Having a high protein content, it supplies the necessary balance to the crops of low protein content—such as Sudan grass and other fodders of that type—and thus enables the farmer to provide feed of a proper nutrient ratio for his stock.

As a grazing crop, the best results—unless rainfall is abundant—are obtained by planting in rows 2 feet 3 inches apart and cultivating once or twice. The crop will be ready for grazing in 50 days or so, and yields of from 12 to 14 tons an acre of green fodder may be produced in 70 days, under good growing conditions. Many varieties suitable for grazing are available, but Victor cowpea has yielded the heaviest growths in the shortest time at the Biloela Cotton Research Station, producing over 15 tons green weight to the acre in 70 days.

As a green manure crop, cowpeas are valuable for orchards, or general farm rotation—their deep rooting, and nitrogen-fixing habits making them especially suitable for this purpose. Such a planting may be broadcast or sown through a grain drill, and will require 15 to 20 lb. of seed to the acre.

In rotations, the cowpea is an excellent predecessor to a cereal, and is recommended to the notice of dairymen who are growing winter wheat or oats for their cows. It should not precede cotton, however, as the nitrate stimulus which follows induces a rank growth of the cotton plant that usually results in a reduced yield.

Menace of Standover Cotton.

A. NAGLE, Senior Instructor in Cotton Culture.

THE soundness of the grassland-cotton rotational method has been demonstrated amply during the past season. As a consequence many farmers in the main cotton-growing areas are planting the whole or part of their acreage of cotton on newly-broken grassland, and intend planting the old cottonfields with Rhodes grass. It seems probable, however, that many old cottonfields that have not already been planted to Rhodes grass will be left for some time as standover cotton.

Experience has demonstrated beyond all doubt that standover fields, through the prolific weed growth associated with them during the spring and summer months, are breeding centres for some of the major cotton pests, such as cutworm and corn ear worm. That being so, they unquestionably are a menace to adjacent fields of growing cotton.

Over a series of years there have been recorded migrations of cutworms, and during the 1934-35 and 1935-36 seasons migrations of corn ear worm, from weedy standover fields to nearby seedling cotton, which have caused substantial loss of stand. The weed growth is also responsible for a big increase in corn ear worm population during January and February, and heavy loss of squares and bolls in crops adjacent to a weedy standover field has occurred even in seasons of generally moderate corn ear worm attack. It is thus imperative that the grassing of standover fields be effected as soon as practicable, to eliminate completely the danger associated with weed growth adjacent to the new cotton.

Although fair stands of Rhodes grass have been obtained occasionally by sowing the seed between the rows of old cotton stalks of the "standover" field during February and March, this practice is not recommended, as more often a thin scattered stand results, and this is insufficient to smother weed growth. The growth made by Rhodes grass planted under such conditions usually is slow, for the reason that the surface soil has been packed hard by the summer rains. It, therefore, is recommended that all standover fields be ploughed before any spring weed growth is apparent, further cultivation being given as it becomes necessary to destroy any weed growth occurring afterwards and to establish a fine seed-bed.

The preparation of a suitable seed-bed for Rhodes grass undoubtedly is advisable, particularly on the old cotton cultivations of the forest soils, as this assists in the establishment of the seedlings and, in addition, ensures a good supply of nitrate-nitrogen in the upper soil to promote a quick vigorous growth of grass.

As the idea of sowing the Rhodes grass on the old cotton cultivation is to check weed growth, improve the physical condition through the development of a large population of grass roots and reduce the nitrate content of the soil, it is advisable to sow the grass at a rate sufficient to give a thick even cover. In this respect it should be borne in mind that usually Rhodes grass germinates only moderately well, so a good rate of sowing should be used—preferably 8 to 10 lb. per acre. Care also should be exercised to avoid sowing too deeply—dragging a brush harrow after broadcasting the seed usually gives ample cover in a normal season.

Seeds Every Farmer Should Know.

F. B. COLEMAN, Officer in Charge, and R. J. HOLDSWORTH, Inspector, Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch.

[*Continued from p. 606, Part 6, Vol. XLV.—June, 1936.*]

(PART III.)

DODDER.

AS an introduction to this article, it may be stated that there are several kinds of Dodder (*Cuscuta* sp.) found in Queensland, the difference between them being in most cases minute.

It has therefore been decided to describe and illustrate a dodder actually found growing on lucerne in Queensland.

The following descriptions of dodder and its most common host plant (in Queensland) lucerne, should be of value in assisting in the identification of these seeds:—

Cuscuta spp. (Fig. 9).

Common name.—Dodder.

Description.—Dull rough seed, brown to very dark brown colour, rounded on one face, flattened maybe on one or more faces, very irregular in shape, could easily be mistaken for a piece of coloured dirt.

Size.—Very variable, diameters from ½ to 1½ mm.*

Occurrence.—Found in seeds of the following cultivated crops:—Lucerne, clovers, linseed (flax).

Medicago sativa (Fig. 10).

Common name.—Lucerne. In the U.S.A. referred to as alfalfa.

Description.—Seeds dull surfaced, of colours varying from light yellow to dark brown, also green, darkens with age, distorted kidney shape but very variable; the hilum mark is a ring with a depression in the middle.

Size.—Variable, average 2 to 3 mm* long by 1 mm thick.

Occurrence.—A commercial crop of great value for feed and seed. Often referred to as "The King of Fodder Crops."

Sometimes one finds a lucerne seed sample containing red seeds. This is the result of action taken by the Commonwealth authorities at the port of entry of the seed to cause a portion of each consignment

* mm = millimetre 25.4mm = 1 inch.

DESCRIPTION OF PLATE 251.

Fig. 9 Dodder x 5.
Fig. 9A Dodder natural size.
Fig. 10 Lucerne x 5.
Fig. 10A Lucerne natural size.
Fig. 11 Lucerne Plant with Dodder half natural size.
Fig. 11A Capsules x 2.
Fig. 12 Lucerne Seed and Dodder Seed x 5.

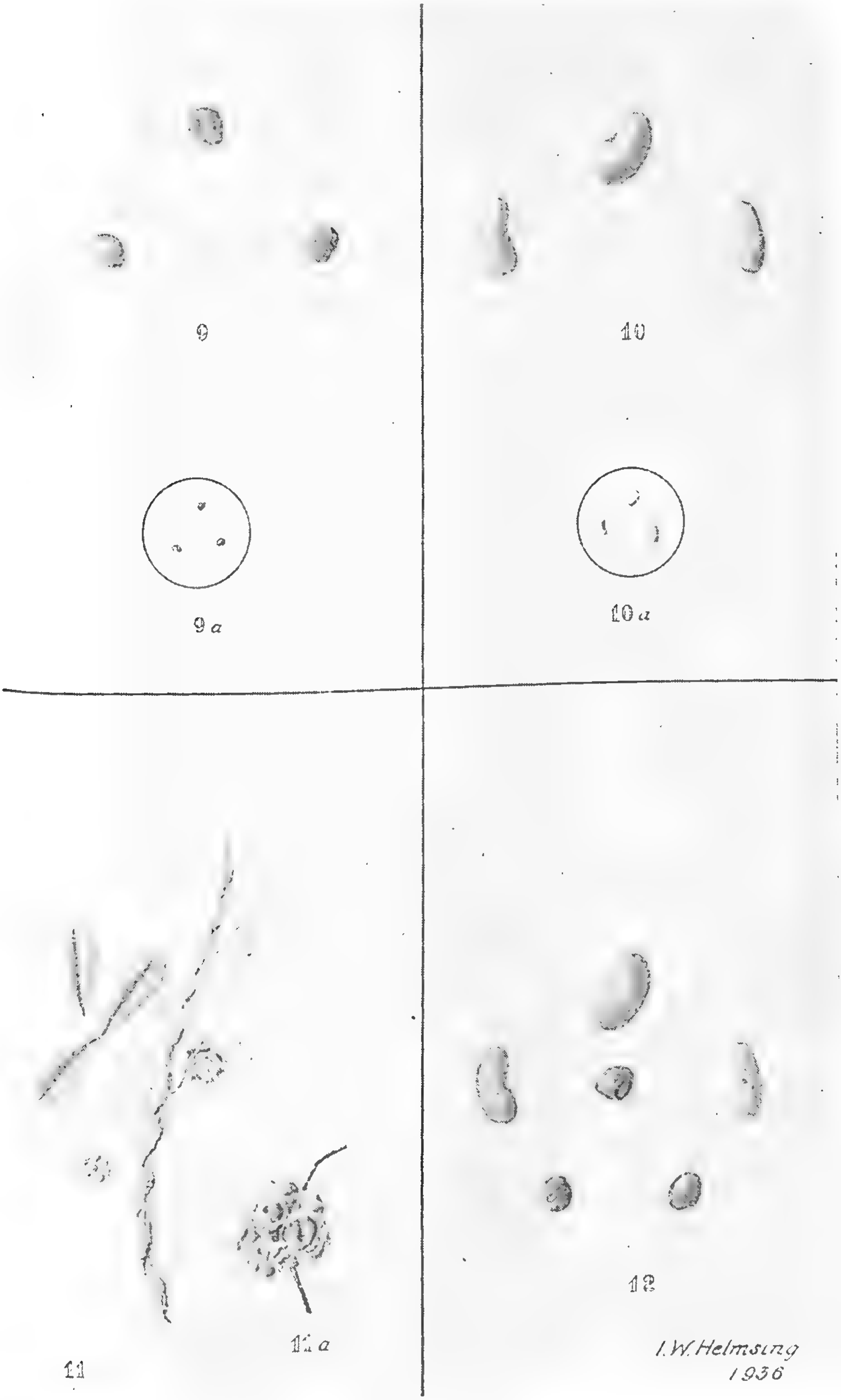


Plate 251.

entering Australia to be stained and then mixed with the bulk to which it belongs, thereby indicating to the buyer that the seed in question was grown outside Australia.

Presence Prohibited.—The seeds of all *Cuscuta* spp. (Dodder) under the Pure Seeds Acts and the seeds, plants and parts of such plants under the Stock Foods Acts, are totally prohibited.

The following extract from "Plants Poisonous to Live Stock," by Harold C. Long, is worthy of repetition:—

> "Dodders (*Cuscuta* spp.), when parasitic on clovers and fed as fodder or hay, have been suspected of causing digestive troubles in horses and cattle in the United States. Muller records a case of poisoning of young pigs by *C. europæa*, with inflammation of the intestines and nervous symptoms. Barbey determined the presence of the glucoside Cuscutin in *C. epithymum.*"

Black's Veterinary Dictionary mentions as follows:—

> "Dodder, Poisoning by.—It seems possible that the parasitic dodder, which may attack clover or hay crops, may, when fed to horses and cattle, cause digestive troubles. The progressive farmer, however, will always take the precaution of having patches of dodder (*Cuscuta europæa* and *C. epithymum*) cut with a scythe from amongst a green fodder crop and burned before any seeds have been produced which will contaminate his samples, or before the parasitic plant has attained serious dimensions."

It should be noted that while clover is specifically mentioned above, the remarks apply equally to lucerne.

Dodder belongs to the convolvulus family. It is an annual parasitical plant found in the warmer parts of the globe. It is leafless, with twining thread-like stems which attach themselves to the host plant by means of tubercles; these are clearly seen in Fig. 11. The dodder seed germinates in the soil, sends up a stem and attaches itself to the host plant which in Queensland is mostly lucerne. The tubercles enter the stem of the host and from then on the parasite draws its nourishment from this source and severs its connection with the soil. The immediate effect is that the host plant is called upon to support not only itself but also the Dodder until ultimately the exhausted plant dies, in most cases smothered in a tangled mass of light brown threads. Dodder quickly produces seed, so that it can run the full life cycle (seed to seed) before the host plant dies—literally from starvation.

Dodder seeds are borne in a globular capsule with 4 seeds in each. These seeds are pressed together, giving them their characteristic flattended surfaces.

Eradication.—If one is unfortunate enough to find this pernicious parasite in a crop the sooner steps of eradication are taken the more chance of success there is. It must be remembered that dodder can be propagated by seed and also by pieces of the threadlike stems, no matter how small they may be. With this in view it is imperative that the method of destruction be such that can take place on the site where the parasite is growing and the best way to achieve this is to burn out the infested patch by covering same with litter, straw, or other readily

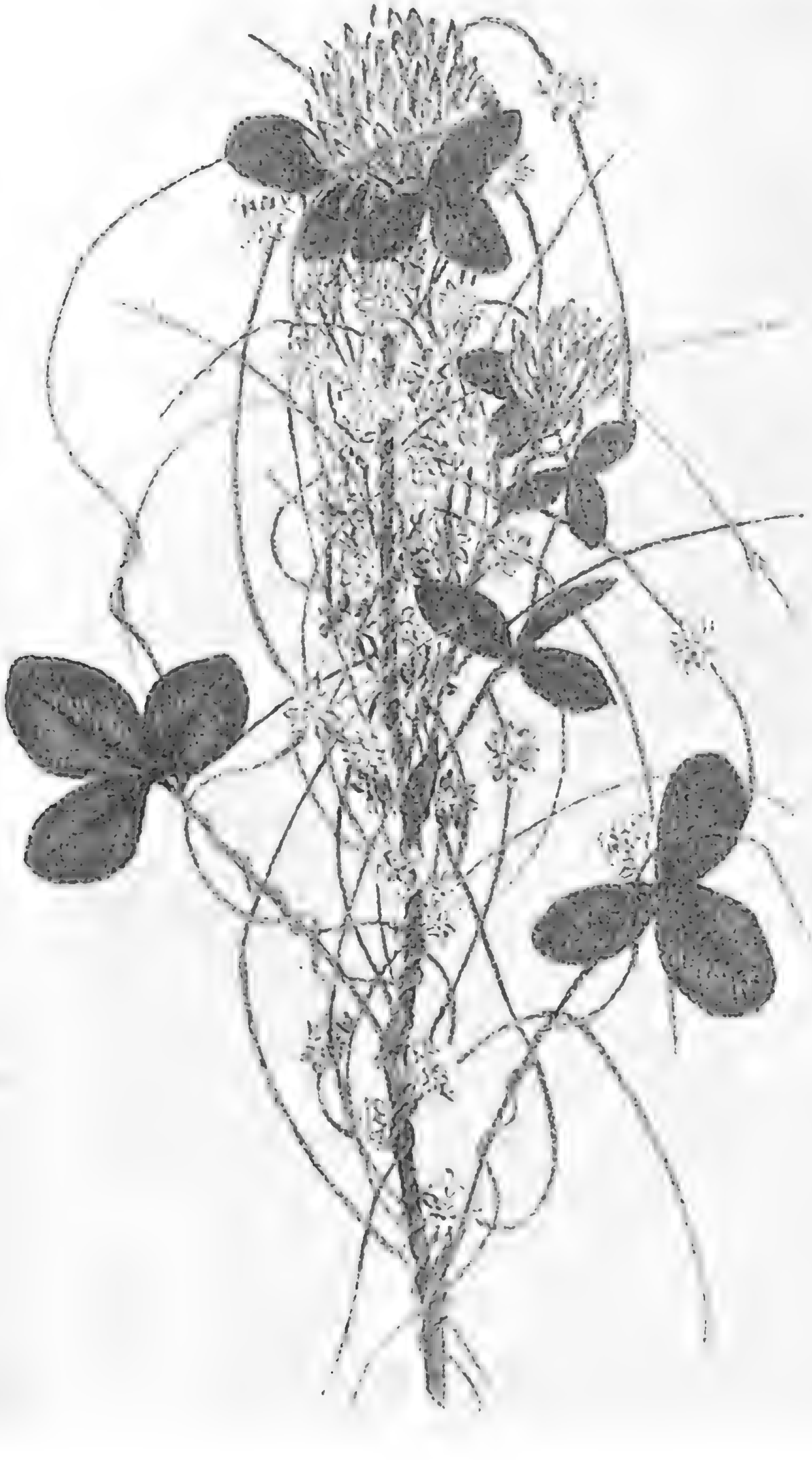


Plate 252.
Red clover heavily infested with Dodder.

inflammable material, taking care to make a considerable overlap into the adjacent apparently free area so as to include any young dodder growth not easily seen. It is best to prevent any persons or animals walking over the infested area, as they are liable to carry seeds or parts of the parasite to the clean area. After burning has taken place a careful watch should be kept in order to detect any minor growths that may occur. All dodder-infested patches should be burnt over before seeding, or harvesting, otherwise harvesting machinery will spread the parasite further afield.

In addition to being parasitical upon lucerne, clovers and linseed (flax)—as mentioned above—it should be noted that Dodders have been found growing on many different kinds of weeds of cultivation in Queensland.

Infestation can result from purchasing agricultural seed containing Dodder seeds, by floods washing the seed or parts of the plant down from higher up the creek or by being carried in earth or mud collected by humans, animals, vehicles or implements.

Unfortunately, there is a considerable quantity of this parasite present in lucerne grown in this State and it is our experience that all the Dodder seed cannot be satisfactorily removed from lucerne seed by means of cleaning machinery or sieving; this statement is based on many unsuccessful attempts to make saleable, parcels of lucerne seed that are Dodder-infested.

Buyers should always insist upon an assurance that the seed they are purchasing is Dodder-free.

Growers of lucerne seed in fairness to themselves as well as to the persons who may sow the seed, *should never harvest seed from a Dodder-infested field.*

It should be borne in mind that any seed for sowing or any material found to be Dodder-infested is subject to immediate seizure and the person offering same for sale is liable to legal proceedings. No excuse can be accepted for the presence in seed or feed of such a destructive parasite which can well be considered as lucerne's worst enemy.

ANAPLASMOSIS.

Anaplasmosis is a disease of cattle which is caused by a minute blood parasite. Under natural conditions it is spread by the tick. When cattle are inoculated for tick fever, it happens frequently that they show signs of sickness about a month to six weeks after the inoculation. This was often recognised by stock-owners and was called the "second reaction." It is now known that this second reaction is due to an entirely different organism from the one that causes ordinary tick fever or redwater.

The chief symptoms are dullness and a disinclination to feed. This lasts for a week to ten days, during which the animal may lose much condition. Jaundice is also seen. Sometimes the animals take a long time to recover completely.

Although the anaplasm is widely distributed throughout the tick-infested area of Queensland, outbreaks of anaplasmosis in the field are unusual. Just recently, however, attention has been drawn to two or three instances of deaths occurring in dairy cows in which inquiry and examination have shown that the mortality was due to anaplasmosis.

Treatment is of little value. It is best to leave the animal alone. Driving the animal is particularly harmful. A mild purgative is useful. Drastic drug treatment of any kind is to be avoided.

—*Dr. John Legg.*

A New Trash Plough.

N. J. KING.*

IN the Canegrowers' Quarterly Bulletin of October 1st, 1935, was printed a short note regarding a new trash-cutting device. This attachment has been considerably improved since that time and has now reached a stage where the experimental period has practically passed. No doubt some minor improvements will still be made, but up to date the plough has made an excellent job of covering some heavy crops of trash.

Plate 253.

New trash plough: position and drive of cutting wheel.

The land wheel of the plough acts as the driving wheel for the cutter. By means of a chain drive and a counter-shaft from the land wheel a second chain drives the cutting wheel at a considerable speed. The cutting wheel, on which the knives are curved, takes the trash against a stationary blade, thus cutting off a length of trash equal to the width of the plough-cut. A shoe runs along the surface of the ground, lifting the trash and guiding it to the revolving cutter. To avoid inequalities in the surface making the shoe dig into the soil the entire cutting device and shoe are swung on two shafts. Should the shoe strike a rise or some high stubble the entire arrangement swings back and up, still cutting the trash, and returns to the normal level when the obstruction is passed.

* In the "Cane Growers' Quarterly Bulletin" (Bureau of Sugar Experiment Stations).

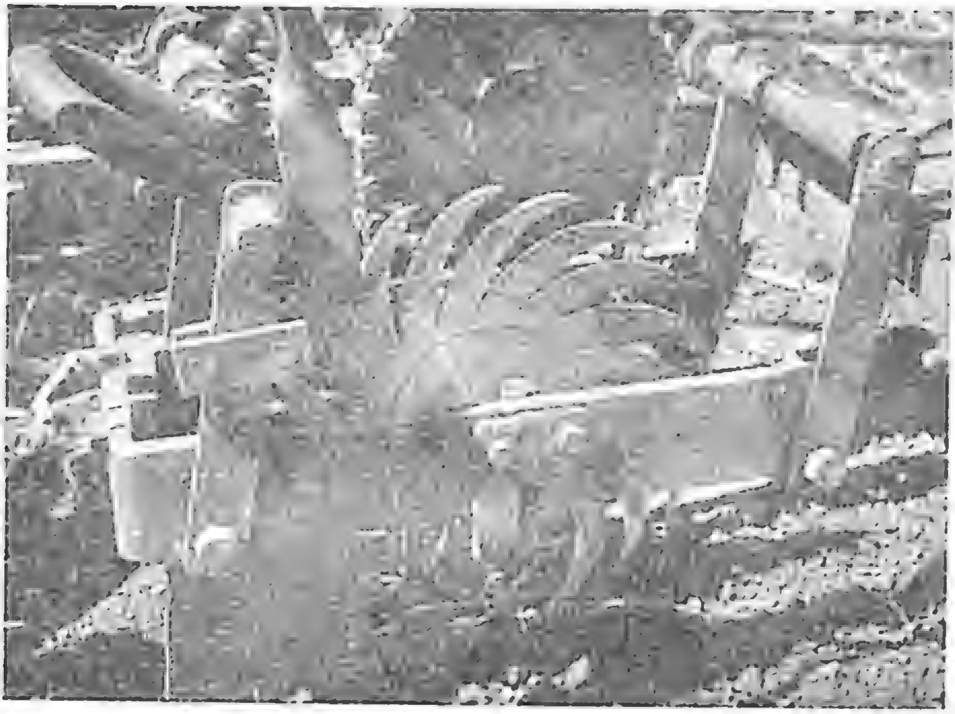


Plate 254.
New trash plough: detail of cutting wheel.

Plate 255.
Illustrating the work of the new trash plough; left: trash covered unploughed land; centre: trash ploughed in with trash plough; right: trash ploughed in with single disc plough.

The photographs illustrate the plough and the cutting device. Plate 255 shows the type of work done; on the right is the result of ploughing in the trash with a single disc plough, while in the centre is shown the result of the trash plough, and on the left the unploughed, trash-covered ground. Dead sticks did not interfere with the cutter. The outstanding advantage of turning in the trash with such a plough is that the trash is directed after cutting into the bottom of the furrow by means of a small mould-board. The cover of soil then covers the trash to a depth depending on the depth being ploughed. In the above case eight inches of soil covered the trash. An ideal seed bed for a green manure crop is thus obtained, and the trash is not mixed up with the soil as is often the case, providing air spaces and allowing rapid drying out. The trash plough illustrated is the invention of a Bundaberg farmer, and undoubtedly promises to overcome the long-felt need for an implement capable of dealing with this difficult material.

SEEDLING HOTHOUSE AT BUNDABERG.

The erection of a new hothouse for the propagation of cane seedlings has just been completed at the Bundaberg Sugar Experiment Station. The house is heated by a hot water pipe system, during cold nights, while the warm humid atmosphere which is maintained throughout the daytime, provides those conditions which make for speedy germination of seed, and rapid growth of the young plants.

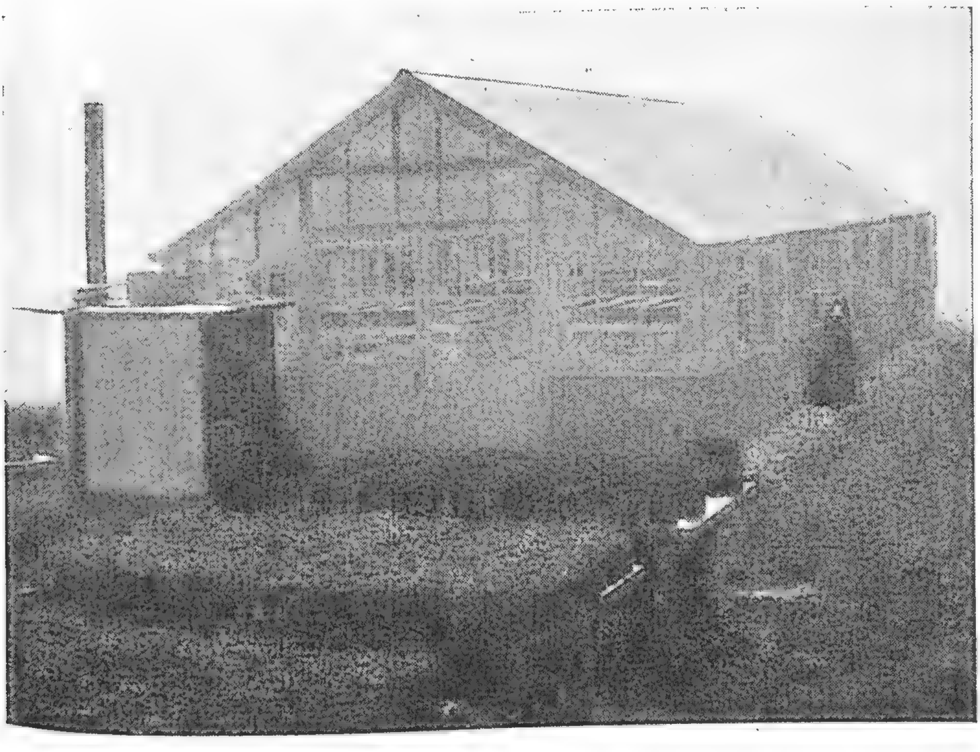


Plate 256.

New seedling house, Bundaberg Sugar Experiment Station.

In the construction of the house, free use has been made of a modern material which has been used successfully elsewhere as a glass substitute. It consists of a cellulose preparation, reinforced by stainless wire gauze, which is highly translucent, and allows free passage of the light rays most active in growth promotion. This material makes for economy in that it is cheaper than glass, both in purchase price and fixing costs, and it is, in addition, hail proof.

In front of the hothouse will be seen the concrete seedling benches on which the potted seedlings are grown. They are set out in a double row, between which runs a tramline, so that the seedlings, in flats or pots, may be transported expeditiously.

N.J.K., in the "Cane Growers' Quarterly Bulletin."

INTENSIVE CANE PRODUCTION.

H. W. KERR.*

It will be recalled that four years ago we commenced a small scale irrigation trial at the Bundaberg station, to demonstrate what could be grown on the red volcanic soils of Bundaberg, when soil moisture and fertility ceased to be limiting factors. The new variety P.O.J. 2878 was planted in the experimental area, and the crop was liberally fertilized and watered throughout its growth period.

We have now the results of three crops—plant, first and second ratoons. The aggregate yield per acre of cane and sugar are as follows:—

Total cane yield per acre (3 crops) ..	**233 tons.**
Total sugar yield per acre (3 crops) ..	**28 tons.**

These yields are far in excess of the Queensland average, and demonstrate still further the extreme value of irrigation as an aid in cane production, particularly where deep fertile soils are available in areas of light and erratic rainfall.

The benefits of the practice have been so vividly proven to growers in the Southern districts that in all mill areas, it is pleasing to note, many growers are attempting to turn all available water resources to good account. Unfortunately, the frequency with which suitable local supplies are encountered is far from high, and in most cases, collective action would be necessary to finance the cost of a scheme designed to effect wider utilization of natural streams.

We have also been able to demonstrate that the fears of serious over-production of cane, due to the adoption of intensive production methods, need have no foundation; growers could reduce their cane acreages proportionately to their tonnage-per-acre increases, and devote the land thus liberated to the production of alternative crops, the growth of which, under irrigation, could also be made worth while. Care in the choice of the supplementary crop selected would also assume the production of those commodities for which a ready market exists.

* In the "Cane Growers' Quarterly Bulletin."

Plate 257.

Artesian bore on Tamburgun Station, near Dirranbandi, Queensland. Capacity, 600,000 gallons a day.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and Jersey Cattle Society, production charts for which were compiled during the month of September, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW, STANDARD 350 LB.			
Empress 32nd of Sunnyside	P. Moore, Wooroolin	9,835·8	436·128	Bruce of Avonel
	SENIOR, 2 YEARS, STANDARD 250 LB.			
Sunnyview Rosemary	C. Stumer, Cooranga	6,311·91	250·468	Lovely's Commodore of Burradale
	JUNIOR, 2 YEARS, STANDARD 230 LB.			
Trevor Hill Cinderella	G. Gwynne, Umbiram	6,112·1	238·35	North Glen Emblem.
College Pigeon 4th	Queensland Agricultural High School and College, Lawes	5,721·5	246·491	College Butterman
	JERSEY.			
	JUNIOR, 2 YEARS, STANDARD 230 LB.			
Glenview Springtime	F. P. Fowler and Sons, Coalstoun Lakes	4,973·3	250·443	Trinity Governor's Hope
Glenmoore Xmas Lily	L. J. Comiskey, Warra	6,024·62	262·316	Wheatlands Jester
Glenview Mayfair	F. P. Fowler and Sons, Coalstoun Lakes	4,741·7	279·854	Trinity Gover nor's Hope
Medowvale Chrysalis (258 days)	Young Bros., Kingaroy	5,613·3	335·227	Kathleigh Jersey King

The Tropics and Man

The Capacity for Work.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology, University of Queensland.

Second Series: No. 4.

NO part of tropical physiology forms a more active battle-ground for opinions based upon prejudice than this question of work capacity. I have endeavoured, as far as I possibly can, to base my opinion upon observed facts and unbiased reasoning from these facts. I am quite aware that my opinion will be assailed from one camp, at least, and possibly from more than one. This fate cannot, however, alter facts, and facts must in the end prevail. I want to run quietly over the observed facts with you first, and then let you make the obvious deductions with me. I am sure that, if you banish prejudice from your minds, you will reach the same conclusion.

Muscular Exertion.

What requirements must be satisfied for the body to do muscular work? First of all, the muscles themselves must be in good order and condition. They must, amongst other things, have enough water, enough of the different salts and the right balance between acid and alkaline substances. Secondly, there must be an ample and continuous supply to the muscles of food substances (especially glucose) and oxygen by the blood-stream. Thirdly, the waste products, particularly lactic acid, must be taken away at a sufficiently rapid rate to avoid undue accumulation. Lastly, but very importantly, the nervous system which stimulates the muscles to action, and co-ordinates the action of muscle to make possible delicate, smooth and efficient movements, must be in the pink of condition.

This list of requirements sounds fairly simple; but anyone who has had to probe the intimate life of body tissues will be well aware of the huge complexity and delicate adjustment underlying each of these requirements. I hinted in the last article at the extraordinary complexity of the human nervous system, for instance. If anything goes wrong with this, it does not matter how efficient the actual muscle is, it cannot be directed to the best advantage.

Faulty Blood Circulation.

The most common disturbance which arises in the tropics, or in hot industries, is a relative failure of the blood circulation. The blood vessels in the skin are often so dilated in an attempt to get rid of heat from the body, that the volume of blood, even when the reserves have been mobilised, is insufficient to fill all the blood vessels properly. The tissues which suffer most are naturally the more delicate ones, and of these the nervous system is the most important. As regards work, the first effect is often a dwindling of the will to work, and a growing irritability which tends to find fault unduly with minor affairs. If care is not taken to combat this mental attitude, and "snap out of it," a vicious circle is often set up, in which necessary exercise and work is neglected

and the bodily condition made worse instead of better. In the less severe degrees of heating the body is inclined to "cry wolf" and utter warnings before they are necessary, and undue notice of them might actually make the condition of the body worse.

If the circulatory failure is more severe, then very definite interference with muscular power is brought about, and if too strenuous attempts are made to overcome this, harm may easily result. The man with the very stable nervous system can often outstrip his more delicately adjusted fellow-workers, but he is the man who is liable to get heat-stroke from a very high rise in body temperature.

Circulatory failure also interferes with muscular action by allowing waste products to accumulate in the active muscles. The familiary muscular soreness following unaccustomed work is due to this, and the sore tiredness of the leg muscles on a hot day is also the result of impoverished circulation in the legs. Muscular tiredness, which is so familiar in hot weather is due partly to nervous disturbance, and partly to an accumulation of lactic acid in the muscles improperly supplied with blood.

Loss of water from the body—dehydration—is a further disturbing factor. As I have said previously, tropical residents as a whole do not drink enough water. Dehydration accentuates circulatory troubles and interferes still further with muscle action.

Loss of salt, if severe, produces very painful muscle cramp and may be fatal. A less severe reduction of salt may be another factor reducing muscle power, although this has not been proved.

A rise of body temperature up to 102 degrees is not a handicap; in fact, it may be an advantage. A rise beyond this is a handicap which increases as the temperature rises. Above this temperature the cells are being worn out too quickly and consequently cannot do their job properly. At 108-110 degrees, the nervous tissue is killed. This is the true heat stroke.

The Net Result.

As a result of experiments conducted in different laboratories and in view of one's knowledge of bodily working, it seems that the position as regards muscular work in the tropics can be crystallised in the following conclusions:—

(1) At effective temperatures below 74 degrees, hard muscular work can be carried out by the average man with little detriment to his body or loss of efficiency. (Only the south-east corner and the mountainous regions of Queensland satisfy this condition at 9 a.m. during the hottest month of the year.)

(2) As effective temperature rises above 74 degrees, the severity of the work which can be carried out by the average unacclimatised man without loss of efficiency or detriment decreases to none at 86 degrees effective temperature. (The highest average 3 p.m. effective temperatures reached in the hot months in Queensland are 84 at Normanton and Croydon, with a little less at Urandangie and Winton.)

(3) The severity of the work can often be temporarily increased above these limits, but it cannot be maintained at this high level, at least without detriment to the body. The body seeks to protect itself against damage by reducing the work capacity.

(4) Training, acclimatisation, social conditions, nutritional state, and interest in the work affect work capacity more readily than at lower temperatures. The extent to which the first two affect local reaction badly needs working out, and will become a point of major research by the Physiology Department in the near future.

Practical Points.

It seems clear from the considerations I have mentioned that at least during the hottest month, a very large part, if not the whole of Queensland, is under conditions during the ordinary working day which threaten or even force a reduction in work capacity as compared with colder climates. It remains to be decided by careful observation and research to what extent it remains a threat and to what extent it is actually, or need be, operative. Training, acclimatisation and deliberate attention to working and living conditions are all important factors and may tip the balance one way or the other.

Even at this stage, certain broad principles stand out whereby the threatened or actual interference may be reduced. In the first place, the fullest use should be made of the very wide range of information available in the field of industrial hygiene, with regard to simple measures for ensuring a maximum of both comfort and productivity in industry. In "industry" I include primary, secondary and tertiary industries, and by "worker" I mean every man who uses his muscles in productive labour. Measures which improve these in temperate countries are even more necessary and useful here. Fatigue in industry has been greatly reduced by attention to details of work, many of them very simple.

In the second place, the effective temperature should be reduced as much as possible by free ventilation and air movement in humid climates and by insulation and evaporation in arid climates.

Thirdly, clothing should afford full movement of limbs and the freest circulation of air over the body, particularly in humid climates.

Fourthly, the nutritional plane of the tropical dweller and worker should be raised to the highest possible point under local conditions, not only by quantity of food, but, more importantly still, by the quality of food, according to modern nutritional ideals.

Lastly, social amenities should be raised and kept at the highest possible plane. Lack of social amenities is one of the biggest deterrents to land settlement and development.

HOME-MADE ANVIL.

A home-made anvil can be constructed from a 4-feet piece of railway metal

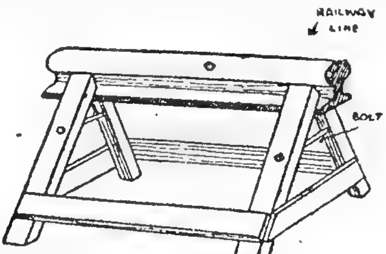


Plate 258.

mounted on a trestle as shown in the sketch. This will stand a lot of heavy pounding and comes in handy in many ways on the farm.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Annual Hibiscus.

R.A.T. (Ardenlea, via Stanthorpe)—

The specimen forwarded represents *Hibiscus trionum*, a small annual hibiscus sometimes known as *bladder ketmia.*. It is widely spread over the warmer regions of the world. In Queensland it is very abundant on the black soil parts of the Central-West, and is often seen as a weed on the Darling Downs.

It is not known to possess any poisonous or harmful properties, and does not seem likely to become an aggressive weed.

Wild Rice.

J.M.R.C. (Emerald)—

The specimen submitted is *Chionachne barbata*, a grass with a fairly wide distribution in the Central-West and North-West. We have not heard a distinctive local name applied to it. About Hughenden it frequently is known as wild paddy or wild rice, although these local names belong more correctly to a true wild rice which grows in North Queensland, particularly about the Gulf country.

Native Tobaccos.

C.S.C. (Mackay)—

The specimens forwarded represent *Nicotiana Debneyi*, one of the commonest of our native tobaccos.

The Australian species of *Nicotiana* have been under review recently, and several species are recognised now which were all listed in the Queensland flora as *Nicotiana suaveolens.*

Variety of Grasses from West Moreton

J.C. (Calvert)—

1. *Cynodon dactylon*, common couch grass. A very nutritious grass, and one of the best fodders we possess. It makes only a light leaf growth, however, and its carrying capacity is not very high.
2. Not received.
3. *Heteropogon contortus*, bunch spear grass. This grass is very palatable in its younger stage, and even when older, I have known it to be made into chaff during drought periods.
4. *Vicia sativa*, var. *segetalis.* This is a variety of the common vetch. It is quite a good fodder.
5. *Digitaria marginata*, summer grass. This grass is very widely spread over the warmer regions of the world. It is mainly a weed of cultivation in the ordinary pasture. It is mostly found on sandy land, and is quite a good fodder.

Milk-tainting Weeds.

G.H. (Booinbah, via Goomeri)—

The worst offenders among the weeds submitted are the various members of the family *Cruciferæ*, which includes a number of weeds frequently known as turnip weeds or mustard weeds. There are other weeds belonging to different families which are very bad offenders in this respect. These include:—

Shepherd's Purse (*Capsella bursa-pastoris*), Bitter Cress (*Senebiera didyma*), Pepper Cress (*Lepidium ruderale*), Turnip weed or wild mustard (*Brassica juncea*), Wild carrot (*Apium leptophyllum*), Fish weed (*Chenopodium triangulare*), Turkey weed (*Rivina lævis*), Melilot or hexham scent (*Melilotus indica*).

Common Weeds. Rattle Pod.

A.J.B. (Proserpine)—

The specimens have been determined as follows:—

17. *Bidens pilosa,* cobbler's pegs.

18. *Crotalaria striata,* rattle pod. This plant is very widely spread over the warmer regions of the world; it is probably a native of Queensland as well as of Asia. It is largely used in some countries as a green manure, particularly in Ceylon as a green manure for tea. It has been proved poisonous to stock, although they do not eat it in sufficient quantities.

19. *Richardsonia brasiliensis*—a very common weed in coastal Queensland. It was boomed some years ago as a fodder under the name of Mexican clover, but so far as our experience goes stock did not take readily to it. It is in no way related to the true clovers or trefoils, but belongs to the family *rubiaceæ.*

20. *Physalis minima,* wild gooseberry. A very common weed in coastal Queensland. It is closely related to the Cape gooseberry.

21. *Boerhaavia diffusa,* tar vine. A very common weed in Queensland, found from the coast to far inland. It is generally looked upon as quite a good fodder for stock. The name tar vine comes from the small sticky fruit the plant possesses.

Weed from East Indies.

K.L. (Ingham)—

The specimen forwarded by the Director, Bureau of Sugar Experiment Stations, in your behalf is *Cleome aculeata,* a native of tropical America, now a common naturalised weed in most tropical countries. It is very abundant in parts of the East Indies, and probably was introduced into Queensland from either Java or Singapore.

The plant has been established in Queensland for many years. We first received specimens of it from Mr. Newport in 1904, when he stated that it was a common weed in paddocks about Kamerunga (Red Lynch). No common name has been applied to the weed. No report has been received as to its having a serious effect upon cane, other than ordinary weeds would have; and neither it nor its allies are known to be parasitic. Although the weed has been established in Queensland for some time it has not generally manifested itself as an aggressive plant.

Yellow Dock.

S. E. McC. (Greenmount)—

The plant you describe as spinach with the deep red root is the curled dock or yellow dock (*Rumis crispus*), a fairly common weed on the Darling Downs, having a very deep red root with a yellow flesh. It is rather difficult to get rid of, as it has to be dug out carefully, and all roots removed. When cut or cultivated the root sends out a new crown. Unless kept in check it is apt to spread from fresh seeds produced every year in the spring and early summer. Mostly only a few plants are seen, but on some farms it is a serious pest.

Perhaps you had better send a leaf or two of the plant to make sure that the yellow dock is the weed you describe.

Grasses and Sedges.

M.W. (Kanighan, via Gootchie)—

(*a*) *Brachiaria foliosa,* leafy panic grass. A broad- leaved palatable native grass.

(*b*) *Bromus unioloides,* prairie grass. Seed heads are necessary to be certain of a determination. Prairie grass is one of the most extensively-cultivated winter grasses in Queensland.

(*c*) *Themeda australis,* kangaroo grass.

(*d*) *Capillipedium parviflorum,* scented top. A rather coarse forest grass, but a useful cattle food.

(*e*) *Cyperus cyperoides,* a sedge and not a true grass. We hope to publish a book in a short time on "Principles of Botany for Queensland Farmers." This will give you the differences between grasses and sedges.

Ironwood. Scrub Wilga. Yellow-wood.

D.F. (Brisbane)—

The specimens forwarded with your letter have been determined as follows:—

1. *Myrtus acmenioides*, ironwood.
2. *Geijera Muelleri*, a scrub wilga. We do not know how the name Johnstone River hardwood could be applied. It perhaps has some superficial resemblance, but the true Johnstone hardwood is confined to North Queensland.
3. *Rhodosphæra rhodanthema*, deep yellow-wood.

Turkey Bush. Ellangowan Poison Bush.

L.A.B. (Brisbane)—

1. *Eremophila brownii.* A plant moderately common in South-Western Queensland, although we have never heard of its becoming a serious pest. It has no local name, but it belongs to the same genus as the common turkey bush of Charleville, and the native Fuchsia (*Eremophila*).
2. *Myoporum deserti.* Ellangowan poison bush. This plant is very widely distributed in Queensland, and grows right from the coast to the far interior. It is particularly abundant in timbered country and grows very rapidly once this country is ringbarked or cleared. It is generally regarded in Western Queensland as a poisonous plant, and feeding tests have proved its poisonous properties. Much of the trouble, however, so far as we have observed in Queensland seems to be with travelling stock. Constipation and acute inflammation of the digestive tract are results of myoporum poisoning.

Native Marjoram. A Suspected Plant.

W.A.K. (Clermont)—

Ocimum sanctum, holy basil, commonly known as native marjoram in North Queensland. The Australian plant is a form or variety of one widely spread in Asia, particularly in India. In that country it is much used as a decoction in fever and bowel complaints. It is also used as a flavouring. The seeds are mucilaginous, and used as a native remedy in the treatment of gonorrhæa.

Pterigeron odorus—A native plant, for which we have not heard a local name. It has been suspected of poisoning stock on one or two occasions.

Caustic Weed.

G.H.S. (Chinchilla)—

Your specimen is *Euphorbia Drummondii*, the caustic weed, a plant very widely spread in Australia. In New South Wales tests for the presence of a prussic acid yielding glucoside have given positive results. Repeated tests with Queensland plants, however, have always yielded negative results, and the symptoms, as described by experienced stock-owners, are certainly not those of typical prussic acid poisoning.

The animals mostly affected are sheep. The head and neck of affected sheep swell considerably; but, if the swelling is pierced, an amber-coloured fluid exudes, and the life of the sheep may be saved, although the head of the animal has the appearance of having been badly burnt.

It is mostly travelling stock that is affected by the plant, and ordinary paddock-resting stock feed on it with impunity.

Age of a horse, as indicated by the teeth.

A.W. (Sarina)—

A few months before three years old, the horse sheds the two centre milk teeth, which are replaced by permanent. Thus the jaw contains at three years old, two centre permanent teeth and two milk teeth on each side. A few months before four, the horse sheds the two next milk teeth, which are replaced by permanent. The jaw now contains four permanent and one milk tooth on each side. A few months before five, the horse sheds the two remaining milk teeth, which are replaced by permanent. Thus the jaw is now furnished with six permanent incisors, but the corner teeth are mere shells, having no internal wall. A few months before six the inner wall of the corner teeth has grown up level with the outer wall. The mouth is now fully complete in incisors, and no further structural changes take place in them. As a general rule, we may add that the upper temporary teeth fall out a little before those in the lower jaw.

General Notes

Staff Changes and Appointments.

Mr. W. A. Winchester (Bundaberg), Mr. A. McTavish (Yeppoon), and Mr. J. T. Littleton (Inspector of Stock, Innisfail) have been appointed honorary rangers under the Animals and Birds Acts.

Mr. F. F. Walcott (Eagle Heights, Tamborine) has been appointed an honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Sergeant (2/C) J. C. Harris (Blackbutt) and Constable P. Tracey (Bedourie) have been appointed also inspectors under the Slaughtering Act.

Messrs. D. R. L. Steindl and C. W. Leece, assistants to pathologist, Bureau of Sugar Experiment Stations, Department of Agriculture and Stock, have been appointed also inspectors under the Diseases in Plants Acts.

Mr. F. W. Olney, gatekeeper, Border Gate, Coolangatta, has been appointed also an inspector under the Diseases in Plants Acts.

Miss E. A. Crees (Ayr) has been appointed assistant cane tester at the Inkerman mill.

Transfers of officers of the Department of Agriculture and Stock include those of Mr. J. A. L. Rheuben, inspector of slaughterhouses, from Maryborough to Ipswich; Mr. C. Caswell, inspector of slaughterhouses, from Ipswich to Maryborough; and Mr. B. Funnell, banana agent, from Brisbane to Cairns.

Mr. J. J. Leather (officer in charge of waterworks, Teddington, near Maryborough), Mr. M. A. New (Maryborough), and Mrs. W. M. Guymer (Rangeville, Toowoomba) have been appointed honorary rangers under the Animals and Birds Acts.

Messrs. H. V. Damm, D. Krueger, J. Neuendorf, and A. C. J. Herrmann (Fassifern Valley), and G. E. Neuendorf (Kalbar), and T. Von Kistowski (Mt. French) have been appointed honorary rangers under the Animals and Birds Acts.

Dr. G. M. Davidson (Eagle Heights) and Mr. F. W. Taylor (North Tambourine) have been appointed honorary rangers under the Animals and Birds Acts and the Native Plants Protection Act.

Sergeant, 2nd Class, A. S. Gordon (Atherton), and Constables F. Purtle (Calen) and J. V. Kelly (Marmor) have been appointed also inspectors under the Slaughtering Act.

Mr. W. I. Coates, "Eversley," Loganlea, has been appointed an honorary ranger under the Animals and Birds Acts.

Broom Millet Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, extending the operations of the Broom Millet Board for the period from 1st November, 1937, to 31 October, 1943.

Trans-Border Stock Restrictions Rescinded.

An Order in Council has been issued under the Diseases in Stock Acts, rescinding two Orders in Council approved in November, 1930, and May, 1933, which placed certain restrictions on the introduction into Queensland of cattle from New South Wales through the crossing place at Killarney.

Trans-Border Fruit Trade.

A Proclamation has been issued under the Diseases in Plants Acts declaring that the introduction of fruit into the South Coast fruit district of Queensland shall be permitted via the border crossing between Coolangatta and Tweed Heads only at the following times:—

Monday to Friday, inclusive: From 8 a.m. to 4 p.m.

Saturday: From 8 a.m. to 12 noon.

Notice of the arrival at the crossing of any fruit or vegetables shall be given immediately to the inspector at the crossing by the person introducing them. The inspector shall inspect all such fruit or vegetables, and if found to be free from disease, shall, upon the payment of the prescribed inspection fees, issue a certificate for their importation.

Northern Pig Board.

Two Orders in Council have been issued under the Primary Producers' Organisation and Marketing Acts in relation to the Northern Pig Board. The first provides that elections of growers' representatives on the Northern Pig Board shall be held triennially and that members elected shall hold office for a period of three years.

The second amendment covers the delivery of pigs to the Northern Pig Board, and provides that pigs shall be delivered to the Board or its authorised agents by the nearest usual practicable road or railway, within such times, at such places, and in such manner as the Board may fix, or as may be prescribed. At present, it is a condition that pigs shall be delivered in such quantities, description, and condition as the Board may fix by notice approved by the Minister, published in a local newspaper or newspapers.

Anzac Festival Competitions.

Details of the competitions in music, literature, and art generally, arranged by Anzac Festival Committee in connection with the commemoration for 1937-38, have been announced. A prize of £5 is offered for the best script for a pageant epitomizing a cycle of British history embracing the birth of Shakespeare, St. George, the patron saint, the landing of the Anzacs on Gallipoli, the arrival of Captain Cook in Botany Bay, and other prizes, will be open to competition, particulars of which can be obtained from the honorary secretary, Miss Merle Harvey, Scot Chambers, Hosking Place, Sydney. A stamped addressed envelope for a reply must be enclosed with each letter of inquiry.

Cane Growers' Council.

The Queensland Cane Growers' Council Regulations, issued under the Primary Producers' Organisation and Marketing Acts, provide, among other things, that a member of the Queensland Cane Growers' Council, a district executive, or mill suppliers' committee must derive at least 60 per cent. of his net annual income (from personal exertion) from the growing and supplying of sugar cane. These Regulations have been amended to the extent that a farmer deriving 80 per cent. of his income from personal exertion from diversified agricultural pursuits and having not less than ten acres of land under cultivation for sugar cane, may be eligible for membership on such council, any district executive, or mill suppliers' committee.

Co-operative Hail Insurance.

A Regulation issued under the Primary Producers' Organisation and Marketing Acts in November, 1936, empowering the Committee of Direction of Fruit Marketing to make a levy on fruitgrowers in the Stanthorpe district to raise moneys to be applied in establishing and maintaining the Stanthorpe Fruit Co-operative Hail Insurance Fund, has been amended to provide that it shall be a condition of cover that all contributions to the fund shall have been regularly and punctually paid by the grower, and it shall be a condition precedent to his right to receive any payment from the fund that he shall have established to the reasonable satisfaction of the board of control that all contributions payable by him have been so paid.

Plywood and Veneer Board.

Orders in Council (2) have been issued under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Plywood and Veneer Board and the Northern Plywood and Veneer Board, in relation to the number of elected representatives on such boards, and providing that elections of growers' representatives shall be held triennially and that members shall hold office for a period of three years.

Two Diggers who fell at Pozieres—Who were they?

The Defence Department announces that enquiries have been instituted by the Imperial War Graves Commission with a view to ascertaining, if possible, the identity of two Australian soldiers whose bodies have been exhumed from a spot approximately 500 yards north-east of the village of Pozieres (Somme), France.

In one case a 9-carat gold ring engraved "T.R. to A.R." was found in one dead Digger's pocket, whilst the remains of the other were wrapped in a waterproof sheet upon which the following particulars can be traced:—

"4540, A. F. . . . . nn, D. Company, 16 Platoon."

Any person who may be able to assist in the identification of these two soldiers is asked to communicate with the Officer-in-Charge, Base Records Office, Department of Defence, Melbourne, S.C. 1.

Rural Topics

Improving Production of Cows.

The success achieved by dairymen in the production of their herds depends very largely on the skill and care bestowed upon the cows. It is an easy matter to pick out two classes of dairymen by the condition of their herds. One group has found it pays to keep cows in good condition, and especially at calving time. The other group, not being alive to the necessity for supplying plenty of the right kind of feed at the right time, and, further, assuming that cows need be fed only while they are giving milk, have cows whose condition is anything but satisfactory at the beginning of a new lactation period. These are the men who should make some improvement in their skill in feeding and caring for cows, if the cows are to make them as much money as they are capable of making under right conditions.

Pastures have been deficient in many parts of the State, and as a result a lot of cows will not be in proper condition to calve and carry on their next lactation period. There, however, is still time to give these cows a fair chance to make good before they settle down actually to milk production.

Good dairy cows should have from six to eight weeks' rest between the close of one lactation period and the beginning of the next. More than this, they should be fed well enough to permit them to regain any condition which has been lost because of the short pasture. It is a very difficult matter to feed cows back to condition after they have calved.

The advice given is:—Look over your cows now and pick out those that need some extra feed, and, most important of all, give it to them. Calving troubles, retained afterbirth, and premature calving are costly. Many of these troubles are due to ill condition and may be prevented by proper care before calving.

The Apiary.

This month nectar will be coming in freely in most of the beekeeping districts, and the bees will need an extracting super. This is a hive body exactly similar to a brood-chamber, and is provided with drawn-out combs, or failing these, with frames containing full sheets of foundation. Most beekeepers put only nine frames equally spaced in a ten-frame hive body when used as a super, because the extra space between the combs allows the bees to make thicker and more even combs, which are much easier to uncap. Further, if these ''fat'' combs are cut down to normal when uncapping, there will also be a material increase in the wax production of the apiary.

If the colony is strong enough, the bees will immediately take possession of the super, but should they be disinclined to go up, a frame of brood may be taken from the brood-chamber and placed above, exchanging it for an empty comb, and this will usually induce the bees to commence storing honey in the super.

Many beekeepers work with a single super to each hive, but it is not the best method, as during a good flow honey is sometimes lost for lack of storage room, while if the unripe honey is removed in order to make room, trouble will occur later on through this watery honey becoming sour and fermenting.

In order to ensure that only thoroughly ripe honey is extracted, and at the same time to take full advantage of a sudden honey flow, several spare supers containing drawn-out combs are necessary. These are tiered up one above the other, as they are required. When adding an additional super to the tier, it should always be placed next to the brood-chamber, and the others containing partly-filled or unsealed comb placed above these two.

The thorough ripening of honey cannot be too strongly recommended, and tiering should be practised, especially in the more humid coastal districts, as the honey is improved in both density and aroma the longer it is kept in contact with the bees.

—*H. Hacker.*

Checking Small Washaways.

Old sacks filled with grass sods placed across small eroded gullies on cultivated land effectively dam up rain water and eventually cause the gullies to fill with soil again.

Colours in Concrete—How to Mix them.

Fine dry colour pigments are used in the preparation of coloured concrete. The usual mixtures are:—

Red: 86 parts of cement and 14 parts of red oxide of iron.

Yellow: 88 parts of cement and 12 of yellow ochre.

Blue: 86 parts of cement and 14 of azure blue or ultramarine.

Green: 90 parts of cement and 10 of oxide of chromium.

Chocolate: 88 parts cement, 6 of black oxide of manganese, 4 of red oxide of iron and 2 of black oxide of iron or copper.

Black: 90 parts of cement and 10 parts of black oxide of manganese or any carbon black.

Pink: 97 parts of cement and 3 of best quality crimson lake.

A few experiments should be made to determine the quantity required. Every batch of colour then should be balanced carefully to ensure regularity in the finished work.

The colour and cement should be blended thoroughly in the dry state. One method is to pass the mixture several times through a fine-mesh plasterers' sieve until a uniform appearance is obtained. The coloured cement should then be mixed with two and a half parts of clean sand until of uniform appearance again. Scoop the mixture out in the form of a crater and pour in the water. The wet mixture should be well shovelled for about ten minutes to obtain the best results.

Where a pure white cement is desired, it is obtained best by using white cement, which is made from pure white limestone and pure white clays. Pure white sand, crushed quartz or crushed marble are the usual constituents.

In the Days when the World was Wide.

The article in the Journal on the subject of overlanding with stock reminds me of the time when I followed the occupation of a drover, writes an officer in the Department of Agriculture and Stock.

My first experience of a long journey was in the early "nineties." Setting out from the Lower Flinders for Bathurst in New South Wales, a distance of 1,500 miles, with a mob of 1,050 bullocks, we reached the end of our journey in twenty-six weeks.

The first "town" was 250 miles from where we took delivery of the mob, and we travelled by way of Jundah, Stonehenge, Adavale, Eulo, Barringdon, and Brewarrina.

We first sighted the railway at Nevertire after a journey of approximately 1,200 miles, and a lapse of five months. With the exception of one beast, which could not be accounted for, the correct number, minus the "killers," were disposed of by auction.

The following year I overlanded a mob of 200 unbroken horses to Dubbo, Orange, and Bathurst.

Sore Teats in Milking Cows.

Sore teats cause much loss to the dairy farmer, and the condition should always be treated suitably on its first appearance. Chapped teats are caused by the sudden chilling of the teats after wet milking, after the calf has ceased sucking, or by contact with stagnant water, filth, or irritants when lying down.

The chapping may be slight, or, on the other hand, it may extend into gaping sores, inducing retention of milk or even causing mammitis.

Sore teats may be prevented by washing the udder and teats thoroughly with warm water and soap when the cow first comes in, carefully drying the udder before applying olive oil to the teats. If the cow already has sore teats, they should be washed with warm soapy water; then thoroughly dried and treated with carbolised vaseline. If the sores are extensive and the irritation great the teats should first be washed with a solution of 1 dram of sugar of lead to 1 pint of rain water, after which benzoated zinc oxide ointment should be applied.

The careful use of a sterile teat syphon is desirable when the sores are very deep and painful, as manual milking opens the sores continually. Wet milking is a dirty and undesirable practice from every point of view.

—*W. Dixon.*

Orchard Notes

DECEMBER.

THE COASTAL DISTRICTS.

THE planting of pineapples and bananas may be continued, taking care that the ground is properly prepared and suckers carefully selected, as advised previously in these Notes. Keep the plantations well worked and free from weeds of all kinds, especially if the season is dry. New plantations require constant attention, in order to give young plants every chance to get a good start; if checked when young they take a long time to pull up and the fruiting period is considerably retarded. Small areas well worked are more profitable than large areas indifferently looked after, as the fruit they produce is larger and of very much better quality. This is a very important matter in the case of both of these fruits, as there is but a poor demand for inferior fruit. Canners only want first-class pines of a size that will fill a can, and cannot utilise small or inferior fruit, except in very limited quantities, and even then at a very low price. Small, badly filled bananas are always hard to quit, and with a well-supplied market they become unsaleable. Pineapple growers are warned that the sending of immature fruit to the Southern markets is most unwise, as there is no surer way of spoiling the sale of the main crop. Immature pineapples are not fit for human consumption, and are liable to be condemned by the authorities of the State to which they are sent.

Citrus orchards require constant attention; the land must be kept well worked and all weed growth destroyed. Spraying for scale insects should be carried out where necessary. Spraying with fungicides should have already been carried out where necessary, and, except in the case of a heavy infestation with black spot or brown spot of the Emperor mandarin, no further applications of copper sprays should be required. A close lookout must be kept for the first indications of "maori," and as soon as it is discovered the trees should either be dusted with sulphur or sprayed with lime sulphur. Borer should be looked for and destroyed wherever seen.

Early grapes will be ready for cutting. Handle carefully, and get them on to the market in the best possible condition. A bunch with the bloom on and every berry perfect will always look and sell well, even on a full market, when crushed and ill-packed lines are hard to sell.

Peaches, plums, papaws, and lemons will be in season during the month. See that they are properly handled. Look out for fruit fly in all early-ripening fruit, and see that none is left to lie under the trees to rot and thus breed a big swarm of flies to destroy later-ripening varieties.

Look out for Irish blight in potatoes and tomatoes, and downy and powdery mildew on melons and kindred plants. Use Bordeaux or Burgundy mixture for Irish blight and downy mildew, and sulphur dust or lime sulphur spray for powdery mildew.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

EARLY ripening apples, plums, apricots, peaches, and nectarines will be ready for marketing during the month. They are unsatisfactory lines to handle. The season of any particular variety is so short that it must be marketed and consumed as quickly as possible. All early ripening deciduous fruits are poor carriers and bad keepers, as their flesh is soft and watery, deficient in firmness and sugar, and cannot, therefore, be sent to any distant market. The available markets are quickly oversupplied with this class of fruit, and a glut takes place in consequence. Merchants sometimes make the serious mistake of trying to hold such fruits, in the hope of the market improving, with the result that, instead of improving, the market frequently becomes more and more congested, and held-over lines have to be sent to the tip. There is only one way to deal with this class of fruit, and that is to get it into consumption as rapidly as possible. Most early ripening fruits are useless for preserving in any way, their only value being what they will bring for consumption whilst fresh. This being so, it is only a waste of time and money to forward

immature, undersize, and inferior fruit to market, as it is not wanted, and there is no sale for it. It should never have been grown, as it is frequently only an expense to the producer. Early ripening fruits should, therefore, be carefully graded for size and quality, handled and packed with great care, and nothing but choice fruit sent to market. If this is done, a good price will be secured, but if the whole crop—good, bad, and indifferent—is rushed in to the local markets, a serious congestion is bound to take place and large quantities will go to waste.

Orchards and vineyards must be kept in a state of perfect tilth, especially if the weather is dry, so as to retain the moisture necessary for the development of the later ripening fruits. Where citrus fruits are grown, an irrigation should be given during the month if water is available for this purpose, excepting, of course, there is a good fall of rain sufficient to provide an ample supply of moisture.

Codlin moth and fruit-fly regulations must be observed in order to keep these pests under control; otherwise the later-ripening fruits are likely to be attacked severely by these pests.

Grape vines must be carefully attended to and sprayed where necessary for black spot or downy mildew or sulphured for oidium.

THE EFFECTS OF RAINFALL ON GRASSHOPPER INFESTATION.

Most of the country people in grasshopper-infested districts are at present remembering that the plague grasshopper is normally abundant only in the drier parts of the State and are hoping that the rain will terminate the present outbreak. There is reason to believe that the prolonged dry weather during the past few years was responsible for the present infestation on the eastern Darling Downs and in the Moreton District. Unfortunately, experience during 1934 indicated that once the insect is temporarily present in large numbers in a district, normal or even greater than normal rainfalls may not prevent further large scale breeding for one or two generations. There is, therefore, no foundation for the hope that now rain has fallen the grasshoppers will necessarily disappear immediately from the districts that have benefited. Rather, the rain will ensure a plentiful supply of food for the insects now present.

This somewhat pessimistic viewpoint is not, however, the only one. Rain should definitely improve the position, if it is necessary to deal with another generation later in the season. Baiting work was complicated in this present generation by the fact that hatching took place over a protracted period and repeated baitings of individual egg beds were often necessary. This may have been due to the exceedingly dry condition of the soil during recent months, and it is probable that with normal soil conditions in early summer, delayed hatchings should not be a complicating factor in any future baiting. One realises also that the free growth of grass and herbage should somewhat lessen the seriousness of grasshopper injury on pastures and at the same time provide some measure of counter-attraction which will lessen the risk of injury to standing crops. It is obvious, therefore, that the rain that has fallen will give certain benefits, but it should not be assumed that there will be no further outbreaks in the closely settled districts which are infested at the present time.

While a great amount of valuable work has been done in controlling the present generation by baiting, it must still be realised that in spite of the rains continued vigilance is necessary in order to deal promptly with such swarms of plague grasshoppers as emerge in the next generation.

—*J. W. Weddell.*

Farm Notes

DECEMBER.

ALTHOUGH November is regarded generally as the best period for planting the main maize crop, on account of the possibility of the tasselling period synchronising later on with the summer rains, December planting may be carried out in districts where early frosts are not prevalent, provided a known quick maturing variety of maize is sown.

To ensure a supply of late autumn and winter feed, dairymen are advised to make successive sowings of maize and sorghums, to be ultimately used either as green feed or silage. The necessity for such provision cannot be urged too strongly. Farmers who have not had any experience in building a silage stack can rest assured that, if they produce a crop for this purpose, information and instruction on the matter will be given on application to the Under Secretary for Agriculture and Stock; also that, whenever possible, the services of an instructor will be made available to demonstrate methods of making silage for the benefit of the farmer concerned and his immediate neighbours.

In districts and localities where supplies of lucerne are not available, sowings of cowpeas should be made, particularly by dairymen, as the lack of protein-yielding foods for milch cows is a common cause of diminished milk supplies and of unthriftiness of animals in dairy herds. Cowpeas and lucerne can be depended upon to supply the deficiency. The former crop is hardy and drought-resisting. When plants are to be used as a fodder, it is customary to commence to feed them to stock when the pods have formed. Animals are not fond of cowpeas in a fresh, green state; consequently the plants should be cut a day or two before use. Economy is effected by chaffing beforehand, but the plants can also be fed whole. Chaffed in the manner indicated, and fed in conjunction with green maize, or sorghum, when in head, in the proportion of one-third of the former to two-thirds of the latter, a well-balanced ration is obtainable. The plant also is a good soil renovator. Pig-raisers will find it invaluable also.

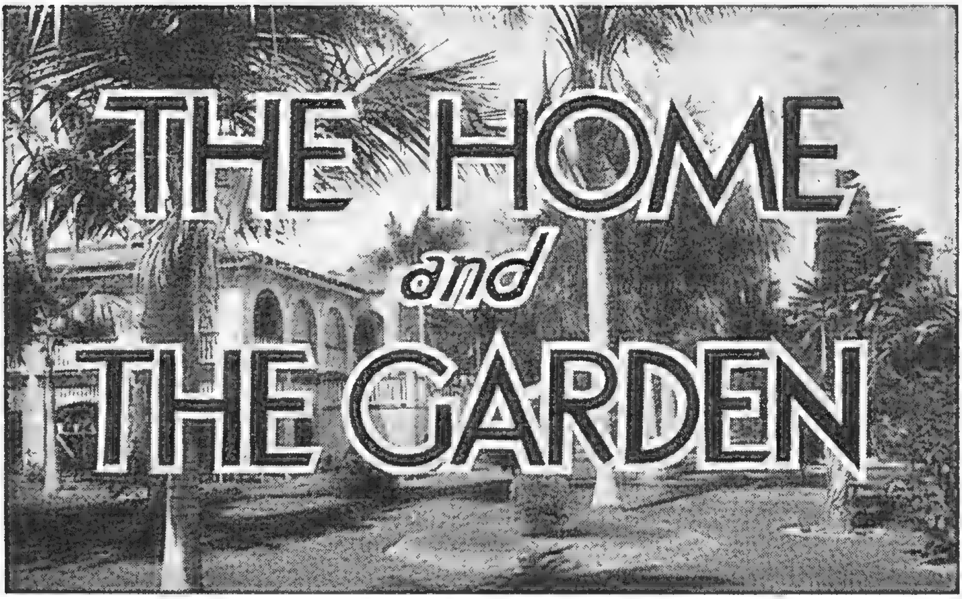
A great variety of quick-growing crops, suitable for green fodder and ensilage purposes, may also be sown this month, notably Sudan grass, white panicum, giant panicum (liberty millet), and Japanese millet. Well-prepared land, however, is required for crops of this description, which make their growth within a very limited period of time.

Successive sowings may be made of pumpkins and melons.

Keep down all weed growth in the cotton field by scarifying as long as the growth will admit of the use of horse-drawn implements.

AERATION AND SOIL PESTS.

Soil aeration has a direct effect on the growth of crops. By soil aeration is meant allowing the air to reach the roots of plants. Access of air to the roots results in better crops. Not only does it mean quicker growth and heavier yields, but the quality will be better. The result of providing a good friable root run, such as can only be obtained by constant soil movement, is that the root hairs or filaments are able to spread rapidly in all directions, and find all the nourishment they need to keep progressing towards a really heavy harvest. If the roots of the plants have a free root run they will use up the biggest possible proportion of the fertilizer, and the farmer will receive the full possible return for his outlay. Another point is that the constant working of the soil disturbs large numbers of soil pests, and gives insect-eating birds a chance to destroy them.



OUR BABIES.

Under this heading a series of short articles, by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

THE HOT WEATHER BOGY.

BABY enjoys the hot weather. There is nothing that pleases him better than to exercise his limbs freely in the most scanty attire, or in nothing at all, unless it is to splash about in a tub of tepid water. He is released from the burden of clothing which oppressed him in the cold season and cramped his movements.

Of course special care is needed during the hot season in some respects. If you over-clothe baby he will suffer from prickly heat. This is caused by excessive sweating, when the sweat is not allowed to evaporate freely. Dress him in cool singlets, not in heavy woollens. Outside the singlet he should wear only the coolest of airy garments, and these should be taken off when he is indoors. Do not torment him with flannel binders. Prickly heat is worst on his back, because he lies on that, and the perspiration cannot dry off quickly. Let him lie on cool sheets or, better still, on cool vegetable mats. Turn him over sometimes when he is asleep and train him to lie on his side.

He does not now need so much heat-forming food. Give him rather less solid food, rather less sugar and fat (clinic emulsion, for instance). But he needs more fluid, so let him drink as much boiled water as he likes between his meals. Do not forget that this is necessary for babies who are on the breast.

During warm weather all kinds of bacteria grow very rapidly, and so food does not keep but undergoes changes which make it unwholesome and sometimes even dangerous. Especially is this true of milk.

You know how quickly it goes sour. Unfortunately it changes in other ways which are more harmful than sourness. Therefore be careful to boil your milk as soon as you get it; then keep it in a cool place carefully protected from flies. Pasteurised milk delivered in bottles does not need to be boiled. It will keep good for twenty-four hours on ice; but otherwise, if you have only one delivery, you will need to boil it within twelve hours if it is to be kept till next morning. Should your milk be stale or dirty before it is boiled it will cause loose motions. When good fresh milk cannot be had you may use dried milk (Glaxo or Lactogen).

Loose motions or diarrhœa is common in warm weather, and needs careful watchfulness. Should your baby suffer from this you must at once stop giving him milk or any kind of food except very thin barley water slightly sweetened. Let him drink as much as he wants; he will be thirsty but not hungry. It may be even necessary to take him off the breast for one or two days. You may also give him one teaspoonful of castor oil to clear out any undigested food. Within twenty-four or forty-eight hours he should be much better, and probably a little hungry. A little breast milk may then be given, or you may then give him whey made with junket tablets, but the whey must first be brought to the boil. If he is over nine months you may also give him some arrowroot, cornflour, or sago boiled with water without milk, or a finger of bread baked hard and crisp. Do not give him milk foods until his motions become natural, and give the milk at first in very small quantity, increasing it gradually.

By this treatment attacks of simple diarrhœa are usually easily cured. But it is very different with diarrhœa caused by infectious bacteria. Of these the most dangerous is dysentery, which attacks us every year in the early summer during the fly season, not, be it observed, in the hottest time of the year, when the epidemic usually subsides.

We hope that our advice will be carefully observed, and that it will save many lives. The cause of the increased sickness and more frequent deaths among our infants during the summer is not the hot weather; it is the prevalence of dysentery and other bowel infections during this season. This infection occurs so frequently because mothers do not know how dysentery bacilli get into their babies. Babies have died from want of knowledge.

IN THE FARM KITCHEN.

EGGS FOR ALL MEALS.

Eggs Tartare.

Take 6 hard-boiled eggs, 1 lettuce, 1 teaspoonful chopped onion, 4 oz. boiled ham, ¼ teaspoonful made mustard, small quantity mayonnaise, pepper, salt, and cayenne to taste.

Shell the eggs and cut in halves lengthwise. Remove yolks and mix to a smooth paste with the onion, minced ham, mustard, pepper, salt, and cayenne to taste, adding mayonnaise to moisten. Fill egg-whites with the mixture. Arrange in a salad bowl lined with lettuce leaves. Place a dab of mayonnaise on top of each before serving.

Scotch Eggs.

Take 4 eggs, ½ lb. sausage meat, flour, egg, and breadcrumbs, nutmeg, flour, salt, and pepper.

Remove the skin from the sausages and season with a little salt, grated nutmeg, and pepper. Boil the eggs hard and remove the shells, dip each egg in flour. When cooking eggs, see that the water covers them completely. Roll each in a cake of sausage meat. Dip in beaten egg and crumb twice. Fry in deep smoking hot fat till crisp and golden. Serve when cold. Set in halves in a dish lined with watercress or lettuce.

Egg and Rice Pie.

Take 4 hard-boiled eggs, ½ pint milk, ¾ oz. flour, 3 oz. grated cheese, 1 oz. butter, 4 oz. rice, 1 teaspoonful chopped parsley, salt, and pepper.

Melt the butter in a saucepan. Stir in the flour. When frothy, stir in the milk. Season to taste with pepper and salt. Boil rice in salted water. Drain when cooked. Hold under tap for a moment or two to separate grains. Drain and re-heat, then arrange round a hot dish. Stir cheese into sauce. Quarter and add eggs. Stir till piping hot. Pour into centre of rice. Sprinkle filling with chopped parsley. Serve with a green salad.

Yorkshire Eggs.

Take 4 eggs, 4 rashers bacon, 4 rounds fried bread, ½ teaspoonful butter, 1 teaspoonful chopped parsley.

Grease four ramekin dishes with butter. Sprinkle with parsley. Drop an egg into each ramekin dish. Place in a saucepan containing hot water, coming half-way up the sides. Cover each with buttered paper. Steam for ten minutes or until set, taking care the water does not boil into the dishes. Remove rind from bacon, and chop and lightly fry bacon. Sprinkle over the bread. Turn out an egg and place on each round of fried bread. Surround with fried bacon. Serve with a green salad.

Anchovy Eggs "In the Nest."

Take 2 eggs, 2 small dinner rolls, 2 oz. butter, a little anchovy essence, chopped parsley, a little milk, seasoning.

Take the dinner rolls and slice off the tops. Scoop out the crumbs inside, mix the anchovy essence with the butter, and spread on the inside of the rolls. Break the raw eggs into these, and season. Put the rolls on a baking tin or sheet. Brush over the outside of the rolls with a little milk, and put into a moderate oven until eggs are set. Sprinkle with chopped parsley. Serve with the lids off or on as preferred. Care must be taken that the eggs are not broken when putting them into the rolls.

Eggs with Cheese Stuffing.

Take 3 hard-boiled eggs, 4 tablespoonfuls grated cheese, ½ pint white sauce, 1 tablespoonful butter, 3 tablespoonfuls breadcrumbs, 1 teaspoonful chopped onion (if liked), pepper, salt, and grated nutmeg to taste.

Shell and cut eggs in halves lengthwise, scoop yolks into a basin, and mash till smooth. Then stir in the cheese, crumbs, pepper, and onion, salt, nutmeg, and a little white sauce to moisten. Stuff each egg-white with the mixture. Mould stuffing until the stuffed half looks like a whole egg. Sprinkle each with a few breadcrumbs, and arrange all in a buttered fireproof dish. Pour remainder of sauce round eggs, place a dab of butter on top of each, and bake in a hot oven till a pale brown.

Egg and Potato Nests.

Take 6 large potatoes, 6 hard-boiled eggs, 6 pats butter, 6 tablespoonfuls grated cheese, cayenne and salt. Bake potatoes in their jackets in the usual way. Cut a slice neatly off the top of each. Carefully scoop out half of the inside of each potato. Shell the eggs and drop one into each "nest." Season to taste with salt and cayenne pepper. Add one pat of butter, then a tablespoonful of cheese. Bake in a hot oven for four minutes.

Egg and Fish Scallops.

Take 5 eggs, 2½ tablespoonfuls grated cheese, ¾ cupful well-seasoned white sauce, salt and pepper to taste, ¾ cupful flaked smoked fish.

Mix the smoked fish and sauce together in a saucepan. Boil for three minutes, and divide mixture between five buttered ramekin dishes. Break an egg into each. Sprinkle lightly with pepper and salt, then with grated cheese. Bake in a moderate oven until eggs are set, in about ten minutes.

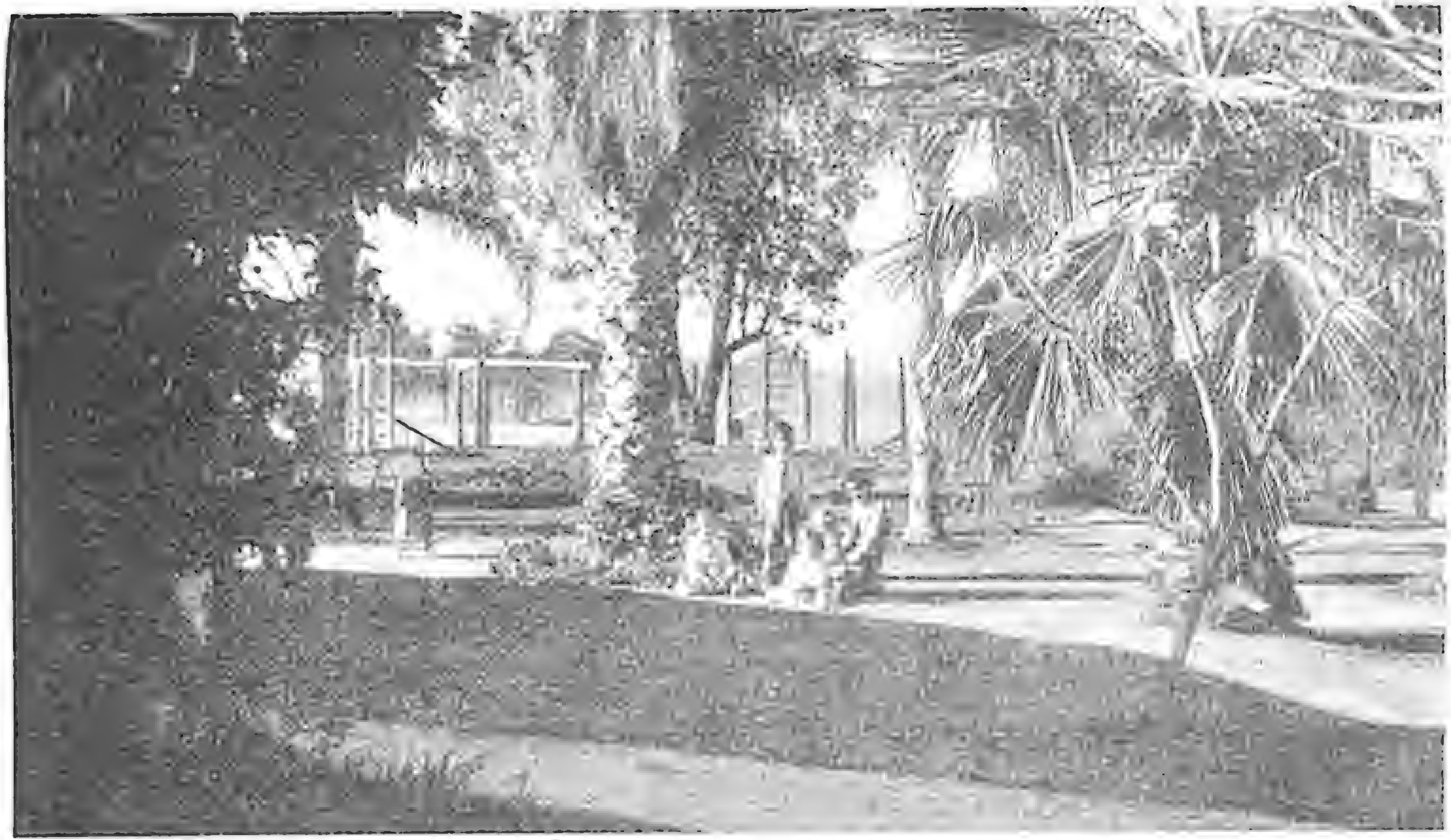


Plate 259. [*Photo.: Department of Agriculture and Stock.*

IN A WESTERN STATION GARDEN. This charming scene was photographed on a recent visit to Yamburgan Station, in the Dirranbandi District, Q.

SOME WHEAT RECIPES.

Wholemeal Nut Loaf.

Ingredients.—Two cups wholemeal flour (finely ground), 1 teaspoon cream of tartar, ½ teaspoon carbonate of soda, 1½ tablespoons butter, 1 tablespoon sugar, ¼ cup nuts, ¼ cup raisins, ¼ cup sultanas, 1 tablespoon golden syrup, 1 egg, 1 good cup milk.

Method.—Mix flour, sugar, cream of tartar, and soda, and rub in butter; add nuts and fruit. Dissolve golden syrup in milk and add to well-beaten egg. Mix all together, put into greased tins with lids on, and bake about three-quarters of an hour in a moderate oven.

A raisin loaf without nuts can be made if desired.

Wheatmeal Fruit Cake.

Ingredients.—Half pound butter, ½ lb. sugar, 1 lb. fine wheatmeal, 6 eggs, 1 teaspoon cream of tartar, ½ teaspoon carbonate of soda, ¼ lb. chopped dates, 2 oz. nuts, ¼ lb. raisins, ¼ lb. currants, 1 oz. mixed peel.

Method.—Beat butter and sugar to a cream. Add eggs one at a time and beat for ten minutes. Add fruit, nuts and peel, and wheatmeal, cream of tartar, carbonate of soda, and a little milk if necessary. Put into greased tin and bake from one and a-half to two hours.

Wheat "Coffee."

Ingredients.—Three large cups of wheat, 2 tablespoons treacle, 1 tablespoon golden syrup, 3 teaspoons salt.

Method.—Wash wheat; drain and put into shallow baking dish, sprinkle salt on and mix in treacle and golden syrup, covering well all the wheat. Put into a hot oven and cook for one hour to one and a-half hours, stirring to prevent burning. When well cooked and the colour of the coffee bean when well roasted, remove from oven and allow to cool. Grind through wheat mill and store in sealed tins to keep in the strength.

Use one dessertspoonful of wheat "coffee" powder to each person, and add the hot milk to the coffee when ready to serve.

IN THE FARM GARDEN.

In planning the farm vegetable garden several points have to be kept in mind. The garden should be protected from prevailing winds and livestock, especially poultry, as well as being handy to the water supply and home. All perennial crops should be on one side of the garden, so as not to interfere with tillage operations. When space is limited, too much room should not be taken up with vine crops.

The garden should be planned so as to be economical of labour, and where possible the vegetables should be sown in rows to allow of inter-row cultivation, and the rows should run the long way of the garden. The garden should not be located near large shade trees, as vegetables require plenty of sunshine. The different crops should be grouped according to their cultural requirements and length of time taken to mature. The best soil is one well drained and rich in organic matter, and an abundance of farmyard manure is almost a necessity.

The home vegetable grower has a wide range of crops to chose from, but there are some crops that are outstanding for growing in the home garden.

The true spinach is rarely grown in Queensland, although when properly prepared it is a delicious vegetable, and superior to the silver beet. Varieties like Bloomsdale Savoy and Viroflay should always find a place in the home garden.

The growing of onions in the home garden is quite a simple matter if sets are used. These sets are miniature onions obtained by planting the seed thickly, late in season. The sets produce large early onions.

Peppers or chillies are rarely grown at all in this State. Being so suitable for savouries, relishes, condiments, and stuffed dishes, they are particularly valuable for home growing. The gherkins, or small black-spined cucumbers, find favour with home growers for pickling.,They are grown like cucumbers, but are harvested when one inch to three inches long. The Boston Pickling is a very suitable variety to grow.

Something Different.

By way of providing something different, sweet corn, not field corn, should appeal to country people. Sweet corn may be grown in the garden to shade such crops as melons. It is advisable to have a succession of plantings to provide corn for a considerable period. It is important to harvest the corn at the correct stage—that is, when the grains are plump and still in the milk stage. It should be gathered just previous to cooking, as the quality is injured if kept for long periods.

Peas and beans give best results for home use when grown on trellises.

A bed of rhubarb is always valuable, and is a good substitute for fruits in the winter.

No home garden is complete without tomatoes, and both early and late staked crops should be grown.

Lettuce cannot be neglected. There are many other vegetables that can be given attention, such as asparagus, herbs, carrots, parsnips, cauliflowers, and melons.

GARDEN SEED SELECTION.

In selecting and saving seed for future plantings, the most vigorous, healthiest, and heaviest-bearing plants should always be reserved for the purpose. Type and production are essentials that should always be observed.

Various methods are used in the harvesting and cleaning of garden seeds, but the actual principles remain more or less steadfast. Seeds should not be harvested until fully ripe or mature. It is equally important that the crop should be promptly gathered when the proper time has arrived. If seed be left too long on the plant, sprouting or moulding may occur, and the seed, at least, will discolour. This is always objectionable when they are required for commercial purposes. Seeds are generally ripe when the pods or seed capsules turn yellow, or the fruits—such as tomatoes and melons—lose their firmness.

Bright sunny weather should be selected, if possible, for the harvesting of crops which require threshing—such as beans and peas. The plants should be dried thoroughly before threshing, and it is always better to select days of low humidity for this operation. No matter how the seed is threshed, the greatest care should be exercised to prevent breaking the seeds or the seed coats. Winnowing is often necessary for the final cleaning of the seed.

In securing clean seed of such fruits as tomatoes and melons the ripe fruits must stand for some time in their juices to remove the mucilaginous covering. A common method is to throw the cut specimens or the scooped-out pulp into any convenient vessel, such as a bucket, tin, or small barrel, and stir daily until fermentation has loosened the covering about each seed. This requires from three to six days. To prevent the discolouring of seeds, the fermentative process should not be continued longer than is necessary.

After fermentation the seeds are separated from the pulp and the skin by washing as often as may be required to obtain clean seeds. The good seeds settle to the bottom of the vessel, while the pulp, skin, and light seeds rise to the top and may be poured off. Three or four washings are usually sufficient, and the use of sieves in this process of separation is recommended.

After winnowing or washing, as the case may be, all seeds must be cured thoroughly before storing. They should be spread in layers upon trays in well ventilated places until thoroughly cured. It is an advantage to wash early in the mornings of bright days to facilitate drying, which should always be done under shade. Seeds may be stored in either cloth or paper bags. The greatest enemy to the preservation of seeds is moisture, but usually the conditions in an ordinary living-room are satisfactory. Provided the seeds are well cured and the humidity remains low ordinary fluctuations in temperature do not affect the vitality of the seed. It is a well-known fact that seeds do not keep well in North Queensland, because of the great amount of moisture in the atmosphere. Some seeds—such as cabbage, turnip, and radish—stand a very great chance of becoming mouldy unless kept in well-ventilated containers.

—*H. J. Freeman, Senior Instructor, Fruit Culture.*

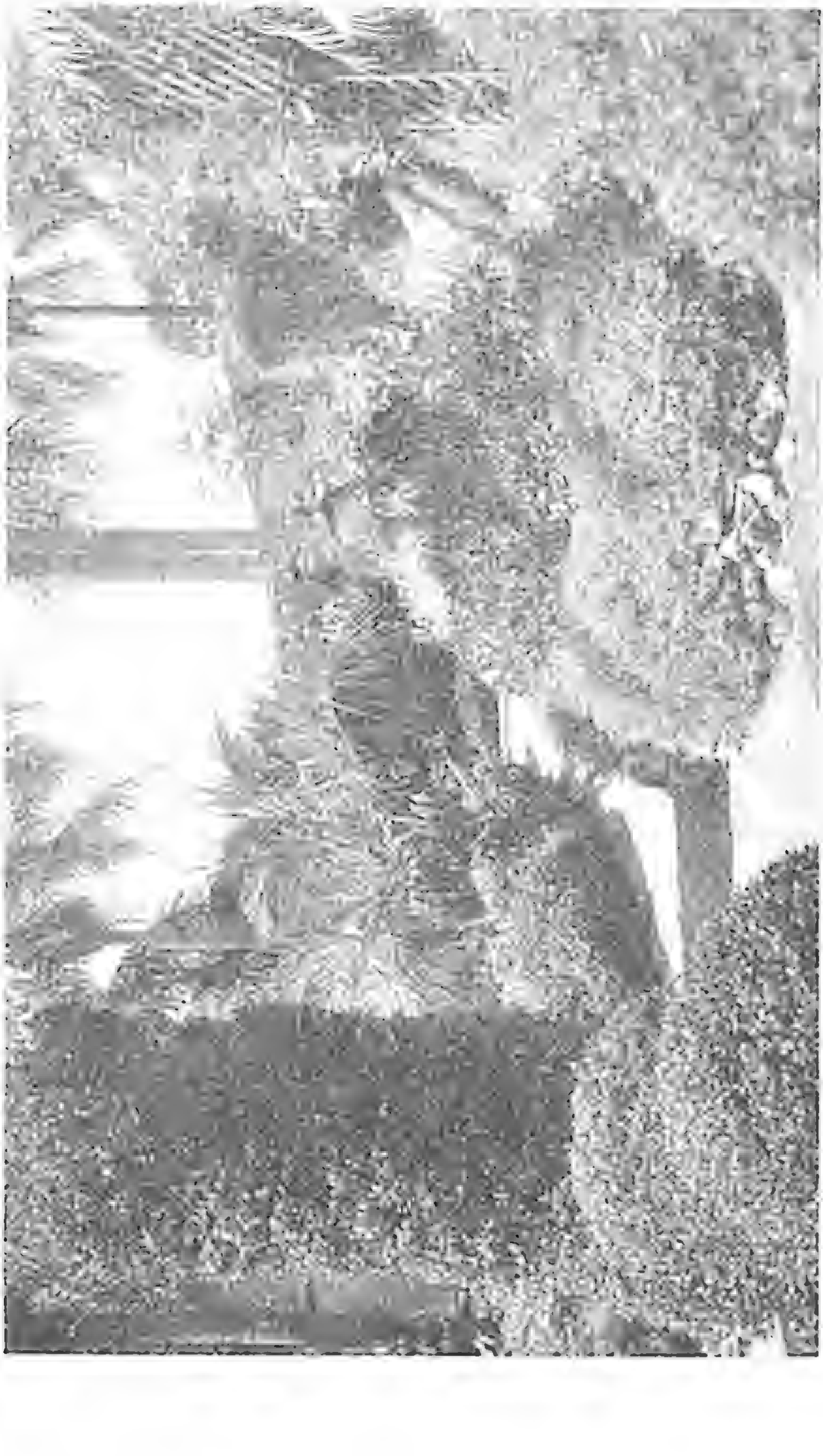


Plate 260.

MORNING IN A BRISBANE GARDEN.—The charm of rockeries, winding paths and palms.

SOME FERTILIZING POINTS.

With the coming of the best rains since March, renewed interest will be taken in the garden, which should be a feature of every farm home. Most soils can be made to produce successful gardens, although the process requires time, energy, some expense, and an appreciation of certain fundamental principles, as well as attention to such important matters as seed and plant selection, and insect and disease control.

Intensive gardening demands a higher degree of soil fertility than does ordinary field crop culture. Not only should an efficient system of soil management make allowance for the present crop, but it should aim at an ever-increasing reserve of fertility. It should determine the necessity and value for the particular soil or organic matter, how most economically to apply this material, then attempt to supplement this where necessary, by liming and the addition of artificial fertilizers.

For the maintenance of fertility the city gardener has to place his chief dependence on chemical fertilizers, and the grower who lacks information as to the plant food content of his soil, and who desires to grow a wide range of crops of whose requirements he knows little, should play safe by using a high-grade "complete" fertilizer, and give a liberal application. Though he applies more than the plants actually require, the increased cost is so slight that the assurance of having enough is worth the additional expense.

A complete fertilizer is one supplying nitrogen, phosphorus, and potash in forms readily available to plants. A generally applicable complete fertilizer for home garden use consists of a mixture of dried blood, superphosphate and sulphate or chloride of potash. These substances in the proportions by weight of 3, 4, and 1 respectively give a 5-11-6 fertilizer, or one containing 5 per cent. nitrogen, 11 per cent. phosphoric acid, and 6 per cent. oxide of potash. On light-textured soils potash could be increased by using the same substances in the proportions of 2, 3, and 1, when a 4-11-8 fertilizer would be obtained.

Dried blood has many advantages as a source of nitrogen. It does not damage seeds or seedling roots; it becomes available when the root system is developing, and therefore is not lost. It is a useful basal form of nitrogen application, carrying plants up to the stage where it may be advantageous to apply forcing soluble nitrogenous fertilizers.

Sulphate of ammonia may be used in place of dried blood in the complete mixture, but should be used in two-thirds the quantity. The use of sulphate of ammonia results in loss of lime from soils, and in time develops strong acidity. These harmful effects are easily overcome by liming, but it is not advisable to use this fertilizer on acid, lime-deficient soils.

The tendency in home gardens is to use quantities of manure without the application of potash and phosphate, and results in a bad nutrient balance, which accounts for the frequent reports of plants producing excessive vegetative growth, with poor flower, fruit, or tuber production. Under such conditions the addition of a mixture of four parts of superphosphate and one of sulphate or chloride of potash would result in a better nutrient balance.

For crops such as lettuce, cauliflower, cabbage, Brussels sprouts, spinach, and celery, where vigorous growth must be maintained, liquid fertilizers can be applied when the plants are well established. The following flowers, provided a complete fertilizer has been used initially, have been found to respond to nitrogenous top-dressing:—Dahlia, chrysanthemum, calendula, Iceland poppy, sweet pea, primula, &c. The soil should be moist before the application of liquid fertilizers.

The most efficient forms of nitrogen for liquid application are nitrate of potash, nitrate of soda, or a mixture of these salts, and nitrate of lime. Sulphate of ammonia, phosphate of ammonia, or a complete liquid fertilizer consisting of nitrate of potash and superphosphate may be used. These substances are soluble in water (superphosphate will leave a considerable residue) and can be dissolved at the rate of 1 to 2 oz. per gallon, and the solution run along the rows from a water-can with the sprinkler removed, or applied with a measure in the case of larger, spaced plants.

If the liquid comes in contact with the leaves, these may be hosed down after the application has been made, to obviate the possibility of injury.

The practice of broadcasting fertilizers is wasteful, since much of it will not come within the absorbing range of roots. When seeds are planted in drills, these should be opened up several inches broad at the bottom and from 1 to 3 inches deeper

than the seed is to be placed. The fertilizer then is distributed along the bottom of the row, at the rate of an ounce or two to the yard, the drill filled in to the desired depth, and the planting made.

With large growing plants that are spaced, such as tomatoes, cabbages, and potatoes, a hole a foot in diameter and several inches deep can be made with a spade, and a small handful of fertilizer scattered in the hole before filling in and planting above the fertilizer. Fertilizers for potatoes should be slightly below and in a ring about the tuber, rather than directly beneath it.

FERTILITY OF THE HOME GARDEN.

Intensive gardening demands a higher degree of soil fertility than does ordinary field crop culture. An efficient system of soil management, therefore, should not only make allowance for the present crop but should aim at an ever-increasing reserve of fertility. To achieve this end a plentiful supply of organic matter is essential.

Organic matter improves both the physical condition of the soil and its water-holding capacity. It also helps to modify extremes of soil temperature. In addition to providing some of the better known mineral constituents required by the plant, organic matter provides certain other necessary elements, usually not considered in the preparation of artificial fertilizers. Some heavy acid soils which fissure badly on drying can be improved in texture often by liming and the addition of organic matter.

The richer the food of animals the richer will be their excreta. Urine contains a great deal of the nitrogen and potash but only a small proportion of the phosphate excreted by the animal, and all three substances are in a form which is readily available for the plant. It is important, therefore, to realise that unless precautions have been taken to include the urine with the solid excreta the value of the manure is much less than it should be.

Horse manure is richer than cow manure, since the mineral requirements of the milking cow are much greater than those of the horse.

Poultry manure, when fresh, is a richer fertilizer than horse or cow manure. It contains more than twice as much nitrogen and phosphate, but has only about the same amount of potash. The bulk of its nitrogen is present in an easily available form, hence it is a quick-acting or forcing nitrogenous manure.

Animal manure, as commonly procurable, has not been carefully conserved, and must be regarded as an unbalanced fertilizer which should be supplemented by the application of artificial manures to the crop.

An annual application of 100 to 150 lb. per 100 square feet is necessary usually to maintain the fertility of the garden soil.

—*H. W. Ball.*

SHEEP LANDS FOR GRAZING SELECTION.

WELLSHOT RESUMPTION.

Portions 3 and 7, parish of Hazlemere, comprising part of Wellshot resumption, will be open for Grazing Homestead Selection at the Land Office, Longreach, on Thursday, 2nd December, 1937, at 11 a.m.

The portions are situated about 30 and 43 miles southerly from Lonreach.

The areas of the portions are 26,278 acres and 23,075 acres.

The term of each selection will be 28 years and the annual rental for the first 7 years is 4d. per acre.

Each selection must be stocked to its reasonable carrying capacity with the applicant's own sheep within a period of 3 years.

Both portions are artificially watered by tanks, but more water will be required. They comprise downs country and are first-class sheep areas, suitable for fattening, woolgrowing and breeding.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agent at Longreach, and the Queensland Government Tourist Bureaux at Sydney and Melbourne.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF SEPTEMBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and stations.	Average Rainfall.		Total Rainfall.	
	Sept.	No. of years' records.	Sept., 1937.	Sept., 1936.
North Coast.	In.		In.	In.
Atherton	0·72	36	1·19	1·89
Cairns	1·69	55	1·62	4·22
Cardwell	1·54	65	1·15	2·41
Cooktown ..	0·57	61	0·47	0·68
Herberton ..	0·56	51	0·60	0·85
Ingham	1·59	45	1·46	3·75
Innisfail	3·53	56	2·96	6·94
Mossman Mill ..	1·73	24	1·26	7·09
Townsville ..	0·77	66	..	0·21
Central Coast.				
Ayr	1·34	50	0·01	0·11
Bowen	0·81	66	..	0·06
Charters Towers ..	0·81	55	..	0·11
Mackay	1·57	66	0·51	1·08
Prosperine ..	2·10	34	0·99	2·28
St. Lawrence ..	1·27	66	0·05	0·08
South Coast.				
Biggenden ..	1·57	38	0·33	0·69
Bundaberg ..	1·60	54	0·07	1·24
Brisbane	2·02	85	0·20	0·84
Caboolture ..	1·86	50	0·30	0·73
Childers	1·82	42	0·13	0·48
Crohamhurst ..	2·68	44	0·23	1·09
Esk	2·13	50	0·35	1·09
Gayndah	1·58	66	0·52	0·55
Gympie	2·12	67	0·74	0·07
Kilkivan	1·72	58	0·70	1·13
Maryborough ..	1·95	66	0·16	0·18
Nambour	2·53	41	0·32	0·64
Nanango	1·84	55	0·53	0·99
Rockhampton ..	1·31	66	..	0·13
Woodford	2·18	50	0·20	0·43

Divisions and stations.	Average Rainfall.		Total Rainfall.	
	Sept.	No. of years' records.	Sept., 1937.	Sept., 1936.
Central Highlands.	In.		In.	In.
Clermont ..	1·02	66	0·04	0·06
Gindie ..	1·08	38	0·05	0·11
Springsure ..	1·31	68	0·09	0·26
Darling Downs.				
Dalby	1·69	67	0·66	1·07
Emu Vale ..	1·78	41	0·78	1·59
Hermitage ..	1·58	31	0·75	1·18
Jimbour ..	1·49	49	0·35	1·25
Miles	1·36	52	0·31	0·89
Stanthorpe ..	2·31	64	0·17	1·50
Toowoomba ..	2·14	65	0·59	1·70
Warwick ..	1·83	72	0·76	1·50
Maranoa.				
Roma	1·43	63	0·27	0·44
State Farms, &c.				
Bungeworgorai ..	0·97	22	..	0·25
Gatton College ..	1·58	38	0·20	1·27
Kairi	0·68	21	..	..
Mackay Sugar Experiment Station	1·50	40	0·42	0·94

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—SEPTEMBER, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure. at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	30·01	81	70	87	22	59	23	47	4
Herberton	..	75	51	85	20	40	6	60	6
Rockhampton	30·15	82	59	91	20	50	23	Nil	..
Brisbane	30·19	77	56	87	19	46	12	20	1
Darling Downs.									
Dalby	30·18	77	48	85	17	34	12, 22	66	1
Stanthorpe	..	69	40	79	29	26	12	17	1
Toowoomba	..	72	48	80	18	32	12	59	2
Mid-Interior.									
Georgetown	30·01	90	62	96	18	52	5	Nil	..
Longreach	30·11	85	55	94	16, 17, 18	43	4	Nil	..
Mitchell	30·16	79	44	96	28	31	12	16	3
Western.									
Burketown	30·02	89	64	94	4	57	6	Nil	..
Boulia	30·07	86	54	100	17	44	2	Nil	..
Thargomindah	30·13	79	52	97	17	42	4, 5, 12	7	2

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

MOONRISE.

	November. 1937.		December. 1937.		Nov. 1937.	Dec. 1937.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	5·3	6·9	4·49	6·31	3·28	3·19
2	5.2	6·10	4·49	6·32	4·4	4·0
3	5·1	6·11	4·49	6·33	4·40	4·44
4	5·0	6·12	4·50	6·34	5·21	5·32
5	5·0	6·12	4·50	6·35	6·2	6·22
6	4·59	6·13	4·50	6·36	6·48	7·16
7	4·58	6·14	4·50	6·37	7·36	8·9
8	4·57	6·15	4·50	6·38	8·27	9·3
9	4·57	6·15	4·51	6·38	9·21	9·57
10	4·56	6·16	4·51	6·39	10·14	10·48
11	4·56	6·17	4·51	6·39	11·9	11·48
					p.m.	p.m.
12	4·55	6·18	4·51	6·40	12·5	12·44
13	4·55	6·18	4·52	6·40	1·1	1·45
14	4·54	6·19	4·52	6·41	1·58	2·49
15	4·54	6·20	4·52	6·41	2·58	3·55
16	4·53	6·21	4·52	6·42	4·2	5·4
17	4·53	6·22	4·53	6·42	5·10	6·8
18	4·52	6·23	4·53	6·43	6·21	7·9
19	4·52	6·23	4·53	6·43	7·29	8·7
20	4·52	6·24	4·54	6·44	8·33	8·55
21	4·51	6·25	4·54	6·44	9·28	9·40
22	4·51	6·26	4·55	6·45	10·20	10·18
23	4·51	6·27	4·55	6·45	11·4	10·56
24	4·50	6·28	4·56	6·46	11·44	11·39
25	4 50	6·28	4·56	6·46	..	..
					a.m.	a.m.
26	4·50	6·29	4·57	6·47	12·20	12·4
27	4·50	6·29	4·58	6 48	12·56	12·42
28	4·49	6·30	4·58	6·48	1·29	1·19
29	4·49	6·30	4·59	6·49	2·4	2·0
30	4·49	6·31	4·59	6·49	2·40	2·42
31			5·0	6·50		3·28

Phases of the Moon, Occultations, &c.

3rd Nov.	●	New Moon	2 16	p.m.
11th „	☽	First Quarter	7 33	p.m.
18th „	○	Full Moon	6 10	p.m.
25th „	☾	Last Quarter	10 4	a.m.

Apogee, 6th November, at 8·0 p.m.
Perigee, 19th November, at 11·0 a.m.

On the 18th a very small partial eclipse of the Moon will occur, of which the ending will be seen in Eastern Australia. When the full Moon is in exact opposition to the Sun, with the Earth between both, our satellite is totally immersed in the Earth's shadow; but when, as on the 18th, it is a little north of the Sun only a very small curve of the circular shadow of the Earth will here be seen on its edge for a short time after sunset.

Mercury rises at 5.10 a.m., 7 minutes after the Sun, and sets at 6.16 p.m., 7 minutes after it, on the 1st; on the 15th it rises at 5.26 a.m., 32 minutes after the Sun, and sets at 7.6 p.m., 46 minutes after it.

Venus rises at 4.0 a.m., 1 hour 3 minutes before the Sun, and sets at 4.24 p.m., 1 hour 45 minutes before it, on the 1st; on the 15th it rises at 3.54 a.m., 1 hour before the Sun; and sets at 4.50 p.m., 1 hour 30 minutes before it.

Mars rises at 9.58 a.m. and sets at 11.42 p.m. on the 1st; on the 15th it rises at 9.49 a.m. and sets at 11.27 p.m.

Jupiter rises at 9.54 a.m. and sets at 11.34 p.m. on the 1st; on the 15th it rises at 9.7 a.m. and sets at 10.49 p.m.

Saturn rises at 3.6 p.m. on the 1st and sets at 3.22 a.m. on the 2nd; on the 15th it rises at 2.8 p.m. and sets at 2.26 a.m. on the 16th.

When, at the beginning of the month, the Southern Cross has disappeared from the evening sky, and of Centaurus only the Pointers are seen above the horizon, somewhat later Argo, the Ship, will arise in the south-east, with its one great light, Canopus, the second brightest of all stars.

At about 9 o'clock, when the Great Square of Pegasus stands four-square on the meridian, the northern constellation Andromeda can be traced by three stars in line with the brightest one on the eastern side of the Square. The star nearest the horizon points westward to the Great Nebula in Andromeda, faintly visible to the naked eye, or in a field-glass, a Spiral Nebula, whose light takes 900,000 years to reach us.

3rd Dec.	●	New Moon	9 11	a.m.
11th „	☽	First Quarter	11 12	a.m.
19th „	○	Full Moon	4 52	a.m.
25th „	☾	Last Quarter	12 20	a.m.

Apogee, 4th December, at 3 a.m.
Perigee, 17th December, at midnight
Apogee, 31st December, at 4 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate; as the relative positions of the sun and moon vary considerably.

ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling**, members of Agricultural Societies, **Five Shillings**, including postage. General Public, **Ten Shillings**, including postage.

VOL. XLVIII. 1 DECEMBER, 1937. PART 6

Event and Comment

Development of the State's Resources.

REPLYING to a welcome to himself and Lady Wilson by the Parliament of Queensland on their return from Great Britain, His Excellency the Governor, Sir Leslie Wilson, remarked that Queensland possessed resources which were denied to other States in the Empire, but its people had the responsibility of developing those resources so that they could pass on a great heritage to future generations.

"No money is wasted if it is spent in developing such a young State as Queensland, whether it be used for the development of industry, the improvement of transport, or that form of development on which I have always been so keen—furtherance of water conservation and irrigation," Sir Leslie added.

Continuing, the Governor said that Queensland was largely an undeveloped State, with great natural assets, and he was confident that they would develop those assets in the future.

His recent visit to England had left him with two outstanding impressions, the first of which was England herself. To-day she was more prosperous than ever before, and her standard of living was higher than for years past. But those factors were not so important as England's standing in the councils of the world.

She stood firm on a policy of commonsense, determined to do all in her power to avoid a world conflagation similar to that of 1914. Other nations looked to her for guidance, and he was convinced that, as a result of that guidance, the world would avoid the disaster with which it was threatened.

The second impression he had received was of the vastly increased interest shown in Australia, particularly in Queensland. Five years ago few people in England appeared to be interested in the Commonwealth or in this State, but to-day business and commercial men knew much about them and were anxious to know more.

He had returned convinced that personal contacts with England were of outstanding importance to the State and to Australia. Without those contacts, either through visits by representative Australians to England or by representative Englishmen to Australia, the two countries could not hope to know as much about each other as they should.

The Governor pointed out that Queensland was the Empire's youngest State, and added that it also was one of the potentially richest. Money and effort spent upon its development, therefore, were well expended, and he was sure that this was recognised by every member of the Legislative Assembly.

"If we as a people are far-seeing enough and brave enough we shall make this State the finest and the most prosperous of the whole of the Dominions of the British Commonwealth of Nations," concluded His Excellency.

Such visits as that from which the Governor had just returned were of untold value to Queensland and to Australia, said the Premier, Hon. W. Forgan Smith, LL.D., who proposed the toast of Sir Leslie and Lady Wilson. They advertised the State and helped the people in the Old Land to appreciate the achievements and aspirations of the Dominion. Sir Leslie had not missed any opportunity of placing Queensland in the forefront, and of giving the people of England an idea of general conditions in Australia.

Modern transport and communication had brought countries closer together, and any conditions affecting Britain or Europe were immediately reflected in Australia. For example, a decline in Britain's national income meant a decline in prices of Australian exports and a consequent shrinkage of our own national income. For such reasons, it was essential that personal contact between the two countries should be maintained. The peace and progress of the world depended upon knowledge and understanding between the nations.

"I am sure that the whole of the people of Queensland are delighted to welcome Sir Leslie and Lady Wilson back here," said the Premier, "for they are held in deservedly high regard and esteem by all sections of the community."

"The Governor symbolises the type of man who has made Britain's history," said the Leader of the Opposition, Mr. E. B. Maher, who seconded the toast. "We live in an unstable world, and the strength and solidarity of the British Empire is the world's greatest hope for peace. A State Governor is the link between the heart of the Empire and its outlying Dominions."

The Export Meat Trade.

DISCUSSING marketing matters soon after his return from abroad, the Governor said that while in Great Britain he had spent quite a lot of time on Queensland affairs. He had been able to tell people who really mattered, perhaps a little more about Queensland than they already knew. In this he had been able to speak from personal knowledge.

He visited Smithfield market and saw shipments of Australian chilled beef being sold, and talked to a number of dealers, who said that Queensland had made considerable progress in chilled beef export during the last two and a-half years, but still had a long way to go. Supplies must be regulated, as regularity was essential, and a certain quantity of Australian beef should reach the market each week. There should not be periods of glut and scarcity. A fast voyage, not exceeding forty-five days, was also necessary. The experts also told His Excellency that Queensland must adopt a definite policy to raise the standard of the beef cattle herds to produce a well-finished, early-maturing animal. Queensland could not really be satisfied until its beef was comparable with the best from other countries. He had been informed that weight grades were of great importance and that hindquarters of chilled beef should average between 155 and 175 lb. Australia, like every other seller, must establish its market, or, in other words, buy its goodwill, whether in chilled beef or in any other commodity.

Wild Life Preservation.

STATE and shire authorities, field naturalists, and other wise people are stirring up popular interest in wild life preservation. This awakening of interest is vivid and significant, and because of it sanctuaries for native birds and animals are being extended in every district. Whole shires have been proclaimed, but the work of education against the folly of destroying a national asset must still go on. In this work the farmer must share. Proclamations and pious resolutions may stimulate public opinion, but that is not enough. No one could be in a better position than the farmer to help in the preservation and restoration of bird life, by which enormous sums in the aggregate can be saved annually to agriculture, and which otherwise would be lost hopelessly through the ravages of crop-destroying insects. Bird life can thus be considered as a farm asset to be protected rigorously and continuously. No one else enjoys contact with living creatures more than the farmer, and no one can benefit by them more directly.

It has been estimated that there are more than four million kinds of insects in the world, and all of them are of significance to mankind. They are mostly open friends or enemies; few are neutral; all compete with man for the world's food supply. Whether man or bug finally inherits the earth will depend, in the last analysis, on which is the more efficient in obtaining the daily ration. In Queensland, we have found that the biological means of fighting insect pests are among the most effective. Birds are among the best of biological agencies, and that is why the boy with the pea-rifle or the shanghai should be encouraged to test his marksmanship, say, on prowling cats "gone bush," and so satisfy his primitive hunting instinct. Therefore, at this time of the year when birds are busily nesting or rearing their young, an earnest appeal is made for active public interest in the protection of wild bird life—one of the cheapest and most effective allies of agriculture.

Groundsel-Bush in South-Eastern Queensland.*

C. W. WINDERS, B.Sc.Agr., Assistant Research Officer.

GROUNDSEL-BUSH or tree groundsel (*Baccharis halimifolia*) is a native of tropical America which first appeared in Queensland towards the end of last century, probably as an ornamental shrub in Brisbane gardens. As early as 1900 it was reported to have strayed from garden culture into the waste places of townships in Southern Queensland and has since gradually extended its range throughout the south-eastern districts until it now occupies some thousands of acres of pasture, forest and waste lands. Beyond the boundaries of the City of Brisbane, within which the weed is very prevalent, groundsel-bush has assumed serious proportions on the North Coast within the Shires of Caboolture, Landsborough, Maroochy and Noosa. The Shires of Pine and Widgee are less heavily infested, whilst light infestations may be expected to be present in shires adjacent to those enumerated. On the South Coast the degree of infestation appears to be light, though a thorough survey may reveal the position to be somewhat worse than casual observation would indicate.

The plant is a perennial shrub or small tree, which has no use in agriculture and which is of very little value for grazing purposes. Much of the groundsel-bush occurring on agricultural and pastoral lands is of a fairly young age and the plants either have not developed beyond a height of about 4 feet and a stem thickness of 1 inch or have been kept in a stunted condition by periodic "brushing." If allowed to grow unhindered the weed may reach a height of 15 feet and attain a stem diameter at the base of 7 inches or more.

The main method of spread of groundsel-bush is by seed. Each "seed" is very small, but is provided with an attachment of hairs which aids in transportation by air. The most prolific spread of the weed is by means of wind-borne seed, but the prevalence of the plant just above the high-water level of streams and drainage canals suggests that dispersal by means of running water may be of some importance. The carriage by people of the showy inflorescences from place to place no doubt also constitutes a common method of spread.

Whilst groundsel-bush is found commonly on vacant allotments about townships and on neglected forest clearings, its most frequent occurrence is in open grasslands, in ringbarked or partially cleared forest, and on abandoned and neglected orchard or crop lands reverting to scrub or forest. So far as could be ascertained in a survey which was by no means intensive the status of groundsel-bush as a weed of agricultural and pasture lands is as set out hereunder.

Groundsel-bush on Cropped Lands.

Practically all of the cropped land within the groundsel-bush-infested districts is devoted to fruits and sugar-cane, and the inter-row and other cultivation associated with the culture of these crops is sufficient to prevent the establishment of most of the seedlings which

* This article is an abridgement of a report submitted to the Hon. the Minister for Agriculture and Stock following a brief survey of the groundsel-bush position in South-Eastern Queensland. Local authorities, community organisations, the Agricultural Bank and various field officers of the Department of Agriculture and Stock provided valuable co-operation.

appear. Occasional instances were noted of groundsel-bush plants developing within the rows of a sugar-cane crop or in open places in the inter-rows after cultivation of the standing crop had ceased. Such cases indicate the need for regular inspections of standing crops and the use of the "grubber." Where simple precautions of this nature are taken the likelihood of invasion of lands under crop is reduced to a minimum.

The menace to crop lands appears to lie in weed rotations and in temporarily abandoned or neglected areas. Cultivated land is commonly thrown out of orchard and other crops and allowed to revert naturally to grass or weeds as a renovation measure. Where groundsel-bush establishes itself in profusion on crop lands in the grass or weed stage of the normal crop rotation, some trouble may be experienced in cleaning the land of the groundsel-bush when cropping is again to be undertaken. Strict supervision of all lands set aside for soil renovation purposes should be exercised and groundsel-bush eradicated as it appears. Neglect to attack the weed in the early stages of its invasion may result in an infestation so dense as to render restoration of the land to crop both difficult and expensive.

The abandoned or neglected area, on which groundsel-bush is permitted to develop unhindered, in some areas appears, almost without exception, to proceed to the stage at which the vegetation consists almost wholly of groundsel-bush in a dense thicket. The reclamation for agricultural purposes of land in such a degraded state presents a difficult problem, and the rather frequent occurrence of groundsel-bush thickets throughout the agricultural lands of the Maroochy River district must be viewed with some concern.

Groundsel-bush on Pasture Lands.

The occurrence of groundsel-bush in pastures of paspalum, Rhodes grass and Kikuyu grass, the use of which has been more or less confined to fertile soil types, is not particularly marked. In most instances these grasses, by virtue of their sod-forming characteristics, form a pasture which is closed to even the most aggressive weeds. Exceptions occur when a poor stand results from the initial planting or when a marked decline in vigor of the pasture or opening up of the stand due to soil exhaustion, drought, improper management, &c., is evidenced. Normally, however, there appears to be no danger of groundsel-bush establishing itself in high-class pastures and depressing the grazing capacity of the land. No doubt seedlings of the weed make their appearance in the inevitable openings which occur in even the most vigorous pastures, but the combined effects of root competition and of grazing of the young weed plants (the latter a corollary of proper grazing practices) ensure the maintenance of a pasture sward with an extreme low proportion of foreign herbage.

Failure to obtain a good strike and rapid development of sown or planted pastures, particularly on "scrub" burns, provides an opportunity for aggressive weeds to take possession of the area. Groundsel-bush, with its facility for mass spread, is well adapted to invade poorly grassed areas which are not protected by topographical or other features from infestation. Some of the most extensive and dense stands of groundsel-bush observed were mass infestations of steep slopes on which the sowing of paspalum seed following a burn was a failure. Fortunately, instances of this nature appear to be infrequent, but the examples seen indicated one aspect of the potential danger of groundsel-bush to good pasture lands.

The employment of severe pasture renovation measures, such as ploughing or drastic harrowing, provides soil conditions suitable to the establishment of groundsel-bush and it appears advisable that farmers should carry out pasture renovation well in advance of the seeding

Plate 261.
Groundsel-bush, showing leaves and inflorescence.

period of the weed, by which time a close sward that will resist invasion should be developed. As an added precaution, renovated areas should be examined at frequent intervals during the few weeks directly following ploughing or harrowing and any groundsel-bush plants dug out.

Pasture deterioration due to old age, drought, mismanagement, &c., is conducive to groundsel-bush infestation and many cases were brought

under notice in which dairymen occupying farms within range of seed-reservoirs of groundsel-bush were obliged regularly to dig out young groundsel-bush plants from paspalum pastures of an order just lower than first-class. It is the medium and low quality paspalum pasture lands that, of all the valuable lands of the North Coast, are threatened most seriously by groundsel-bush. Many holders of land falling within these categories appear to realise the necessity for unceasing vigilance and the careful farmer usually finds it practicable to control the pest on his sown pasture areas. The employment of control measures tends, however, to become a heavy burden to farmers whose pastures lie within the zone of dense flights of wind-borne seed.

The self-established type of pasture which occurs on ringbarked or partially cleared forest land offers, due in part to its nondescript nature and in part to the loose management usually applied to it, a fairly open field for groundsel-bush establishment. Much of this type of pasture is, however, protected from the weed because of the dryness of the soil. Where the original forest has developed under fairly moist conditions groundsel-bush may be considered a potential menace to the pasture which follows on clearing. On dry ridges no heavy infestations were observed, but the paucity of the weed there may be attributed possibly to the fact that dry, broken, forest country is seldom cleared in any but a light fashion and the shade cast by the green trees is sufficient to prevent heavy groundsel-bush invasion. Where groundsel-bush was observed on dry, forest country it was restricted largely to the edges of the forest or to cleared spaces.

Reclaimed or partly-reclaimed swampy and marshy country appears to be a very suitable situation for groundsel-bush. Only a few thousands of acres of this type of country have been improved for pastoral or agricultural purposes, but it has been found that removal of the green timber and draining predispose the land to heavy groundsel-bush infestation.

Requirements for Groundsel-bush Development.

The climatic conditions required by groundsel-bush for its normal annual development, including seed ripening, appear to be a long, warm summer and an annual precipitation of more than 40 inches of rain, of which most occurs in the summer. These are the conditions experienced in the strip east of the coastal ranges. To the west of the ranges the rainfall may be too low to permit of groundsel-bush developing and spreading, though in "soaks" and other moist places establishment may occur.

The elevational range of the plant is from sea-level, or lower, to the highest points of the Blackall and other coastal ranges. Although the densest and most extensive stands occur at low altitudes, this may simply be due to the fact that the original distributing centre was near sea-level. As a matter of fact, a particularly dense stand of groundsel-bush was observed high up on the Maleny plateau in close proximity to an area where the plant had once been cultivated.

Infestations were observed on all slopes and exposures, but dense stands were seen only in those situations exposed to seed-bearing winds. Close to the coast the prevailing winds at seeding time of the groundsel-bush are south-east in direction and country with a north-western exposure is protected to some extent from wind-borne seed. On the higher parts of the Blackall Range the winds experienced at seeding time

have a westerly component and on the lower slopes heavy infestation from the highlands is confined to country facing the west. Although wind-borne seed appears to be the main source of infestation of new areas, transference of seeds by water probably is a channel by which clean areas may become infested.

As previously indicated, groundsel-bush occurs on a wide range of soil types, including rather dry, infertile forest soils, rich volcanic loams and low-lying clay soils with a high moisture content. Though plants of the weed were observed in some very damp situations, permanently water-logged areas appear to be immune from heavy infestation. Nevertheless, soil moisture content seems to be a limiting factor, the most vigorous and densest stands occurring on soils well supplied with moisture. Healthy, well-developed plants occur just below high tide mark near the mouths of several coastal rivers. Some evidence that, other things being equal, eroded soils are more favoured by the weed than are entire soils, was collected, but no definite conclusion was reached on this point. Since the soils within the groundsel-bush-infested region naturally are generally acid in reaction, no information concerning the limits of soil acidity which the plant will tolerate was obtained.

The light requirements of groundsel-bush appear to be high. No infestations were observed in dense "scrub" nor in virgin dense forest. Invasion of these types of timbered land does not occur until the timber is thinned out and abundant light admitted.

Effect of Groundsel-bush on Animal Health.

As a consequence of reports of suspected poisoning of stock by groundsel-bush on the north coast, feeding experiments were conducted at the Animal Health Station at Yeerongpilly some years ago. Two Jersey heifers were fed for thirteen days on a ration of chaff and groundsel-bush leaves in almost equal proportions by weight. Neither animal showed any sign of ill-health other than a tendency to constipation. Three guinea pigs fed exclusively for twelve days on groundsel-bush leaves became greatly emaciated and anaemic and one died, apparently from malnutrition.

Information collected during the course of the recent survey corroborated the conclusions which may be drawn from the feeding experiments. Stock browse groundsel-bush to only a slight extent when ample nutritious grass is available. When grass is scarce the groundsel-bush is grazed, often quite heavily. Animals ingesting large quantities of the weed daily over a long period lose condition and milking cows drop considerably in production. Any effects on the stock appear to be due to malnutrition rather than to poisoning.

Control of Groundsel-bush by Natural Agencies.

The only natural agency which appears in Queensland to exercise more than a slight degree of control over the development and spread of groundsel-bush is climate. To what extent meteorological conditions restrict the weed is not definitely known, but west of the coastal ranges the climate probably prevents establishment and growth.

White wax scale, accompanied by "sooty mould," is a common pest of groundsel-bush throughout its whole range in Queensland, but only in isolated instances has it any marked effect upon the health of the plant. It is possible that infestation by the scale and its associated

fungus hastens the end of sickly plants, but vigorous plants of all ages show little ill-effects. White ants have been reported as destroying occasional plants. No pathogenic fungi have been observed to attack the plant, and the only physiological disturbance which has been noted is a die-back of terminal shoots that has been attributed to unfavourable soil moisture conditions.

No information is available concerning the incidence of pests and diseases of groundsel-bush in other countries. Little hope is entertained that biological control will prove feasible, but any attention that can conveniently be given to the matter is warranted.

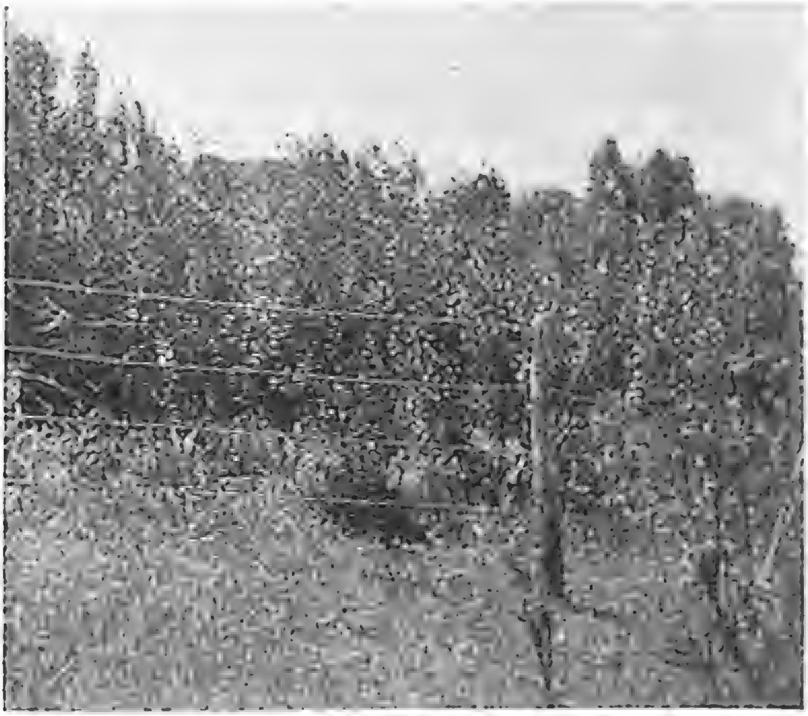


Plate 262.
A coastal pasture invaded by Groundsel-bush.

Mechanical Methods of Control of Groundsel-bush.

Landholders within the groundsel-bush-infested region employ various mechanical methods aimed at the control and eradication of the weed. These include digging ("grubbing"), cutting ("brushing" and mowing), pulling or dragging, ploughing and burning.

Digging.—The use of the "grubber" has been found a fairly effective means of exterminating groundsel-bush on lightly infested land. To prevent regrowth it is necessary to remove all underground parts which are capable of shooting if left in the soil. This is simply done when the plants are young, but older plants may develop a deep tap-root, extensive lateral roots, or underground running stems, all of which are difficult to remove entirely.

The eradication of dense stands of groundsel-bush by digging demands the expenditure of a large amount of labour and in some instances, at least, is beyond the capacity of the landholder to accomplish.

Cutting.—"Brushing," with or without subsequent poisoning or "firing," is the commonest method employed for dealing with heavy infestations of groundsel-bush. It is generally held that "brushing" at budding or during blossoming is effective in weakening the plants and many may die. Regrowth is, however, far from eliminated by "brushing" alone, and poisoning or "firing" following "brushing" has been adopted by some farmers. Arsenical solutions swabbed on the butts appear to give a good "kill," but some danger is occasioned to stock. "Firing" a "brushed" area possibly increases the amount of weed destroyed but does not appear to be as effective as poisoning after "brushing."

On one property inspected a standard type of mowing machine is employed on flowering "whip-stick" groundsel-bush plants up to three feet tall and one-half inch or more in stem diameter. The action is, of course, similar to brushing and has approximately the same effects on the plants.

It is probable that cutting frequently during the season of growth would kill the plants, but such a procedure would hardly be economic.

Pulling.—On certain soil types in wet weather or after rain young groundsel-bush plants can be pulled out by hand, but this method of eradication is practicable only on a small scale.

On one heavily infested, lowlying property a tractor-drawn, triangular drag of flanged steel rails has given fairly good results. The apex of the drag is drawn foremost and in sliding between two groundsel-bush plants with large crowns levers them out of the ground. The jolting of the rails also levers out many plants. Young plants with a poorly developed crown are seldom uprooted, whilst a proportion of the well-developed plants escape permanent injury. It has been suggested that a modification of this implement, or a mallee roller, would prove fairly effective.

Ploughing.—Plants which have not attained the stature of a tall shrub or tree can be effectually eradicated by ploughing and subsequent harrowing. Because very little of the pasture land on the north coast is ploughable, only a small proportion of the groundsel-bush-infested country could be so treated.

Burning.—Dense stands of groundsel-bush will take a running fire or a flamethrower fire quite well when the plants are maturing and burning of an area on which there is a good body of grass will cause damage to groundsel-bush plants of all ages, but regeneration from protected portions of the plants is quite common and burning alone does not appear to offer a particularly effective means of eradicating the weed.

Covering.—Though groundsel-bush is intolerant of shade, there seems to be little prospect of successfully exploiting this characteristic for control purposes. The principle of prevention of growth by light exclusion may perhaps be applied in special circumstances by encouraging the growth of, or even by making special plantings of, trees.

Flooding.—An area of groundsel-bush-infested pasture which had been submerged in fresh flood waters for three days some short time after being partly "brushed" was inspected. Both entire and "brushed" plants which were completely submerged during the period of flooding had perished, whereas plants which had been only partially

covered or which had suffered immersion for only a short time survived. At the present time the employment of flooding for groundsel-bush destruction is nowhere practicable.

Heavy Grazing.—It has already been remarked that on well-managed pasture areas any groundsel-bush seedlings which appear are destroyed by the stock. One of the requisites is periodical heavy concentration of stock on the area. On undergrazed pastures weed development is encouraged, whilst continuous heavy grazing weakens the pasture plants and permits of groundsel-bush intrusion. Stock may, therefore, be used as scavengers of very young groundsel-bush, but on areas heavily infested with woody groundsel-bush plants grazing stock have little influence on the weed.

Chemical Methods of Control of Groundsel-bush.

The only weedicides which are employed in groundsel-bush eradication are arsenical in nature. Arsenic pentoxide is favoured by most landholders because of cheapness and convenience, but proprietary mixtures are used to some extent. Chlorates and other materials non-poisonous to stock do not appear to have been tested.

Arsenical preparations are employed most commonly for swabbing the butts of "brushed" plants and appear to give good results. The method has not been standardised and little information could be secured concerning costs of application.

Some farmers have used arsenical preparations in the form of sprays. Penetration of the poison is declared to be less efficient than might be desired. This may be due to run-off from the smooth leaf and stem surfaces (in which case a spreader is indicated), or it may be the result of high resistance offered by the plant surfaces to the action of corrosive substances, calling perhaps for the addition of concentrated sulphuric acid or some other strongly corrosive material to the arsenical solution.

The best time of application of sprays to groundsel-bush appears to be in late summer, towards or during the blossoming period, but the information obtained on this point was suggestive rather than positive. Young suckers which appear after "brushing" or burning are said to be very susceptible to destruction by sprays at any time of the year, as also are seedlings.

Resumé of Practical Control Measures.

The small-scale spread of groundsel-bush may be checked if landholders of all descriptions dig out the occasional plants as they appear on their properties, and eradicate by digging any adjacent small patches which may be acting as breeding grounds. (In several localities grazing farms were examined which were infested to the extent of only a few bushes, yet these were allowed to remain to constitute a potential source of wholesale spread.)

The treatment of existing stands will vary according to circumstances, though it must be confessed that the control and destruction of dense infestations presents, in many instances, a task of considerable magnitude. Infestations of medium to high density do not appear to be controllable (except to the extent of preventing seed-setting) by simple mechanical measures such as digging, pulling or infrequent cutting, nor does the encouragement of natural enemies offer much promise.

The use of a weedicide seems definitely indicated, and until some treatment combining efficacy, economy and safety is elaborated the use of arsenic pentoxide dissolved in water might be advocated for dealing with infestations rather too dense to warrant the employment of manual methods of eradication.

Some community effort to eradicate, or to eliminate the potency of, breeding grounds on public roads, &c., and on abandoned properties might be urged. This could take the form of destruction of colonies or of cutting back prior to seeding. Such action is particularly desirable where the occurrence of the weed is a menace to clean areas.

Summary and Conclusions.

Groundsel-bush is an American weed which, since its escape from garden culture over thirty years ago, has invaded some thousands of acres of agricultural, pastoral and waste lands in the coastal portion of south-eastern Queensland.

Though cropped lands are as yet not extensively invaded by the weed, a task of some magnitude lies in the reclamation of numerous temporarily abandoned and neglected areas on which a dense infestation of groundsel-bush occurs.

Vigorous pastures of the sod type are little affected. Fertile pasture land on which a poor cover of grass has followed sowing or on which the pasture has been opened up by drought, mismanagement or old age is fairly readily invaded and a considerable area is infested to some extent.

Except for the small proportion which occurs on moist soils, the self-established pastures of medium to low class forest country have not suffered a heavy infestation, although further destruction of the existing timber may lead to increase of the groundsel-bush.

Reclaimed or partly-reclaimed swampy or marshy country offers a very suitable habitat for groundsel-bush and serious infestations occur on this type of country.

The effect of groundsel-bush invasion of pastures is to lower pasture production and to undermine the health of stock forced to graze upon the weed.

Though groundsel-bush is attacked by one or two natural enemies, these appear to have but little effect upon the plants and to exercise only slight control of their development and spread.

Various mechanical methods of treatment of groundsel-bush are effective in eradicating light infestations, but some form of chemical treatment appears to be indicated for the control and eradication of dense stands.

The critical investigation of control measures applicable to existing dense stands seems to be warranted.

Yellow Spot Disease of Pineapples.*

H. K. LEWCOCK, M.Sc., Senior Research Officer.

YELLOW spot was first recognised as a specific disease of pineapple plants in 1926 when it made its appearance in Hawaii on the island of Oahu, but a description of the disease was not published until five years later.[2] For some time the disease was confined to the Hawaiian Islands. In 1928, however, it made its appearance in the Philippines, having probably been introduced there in planting material obtained from Hawaii.[6]

For six years following the first published account of yellow spot nothing even remotely resembling this disease was found in Queensland pineapple plantations, notwithstanding that the insect which transmits the disease from plant to plant, namely *Thrips tabaci* L., was known to be prevalent on pineapples in Queensland even before the disease was reported from Hawaii. Early in October of this year, however, a diseased pineapple fruit was submitted for report from a grower in the Mary Valley and the disease symptoms present in this fruit appeared to be identical with those which have been described for a particular phase of yellow spot disease in Hawaii. This tentative diagnosis was verified by an inspection of the plantation from which the diseased fruit had originated. During the course of this inspection, the characteristic foliage symptoms of the disease were clearly recognised on the leaves of affected tops and in nearly all cases these leaf symptoms were associated with necrosis (breaking down) and decay of the apical fruit tissues.

This outbreak of yellow spot disease which, as yet, is the only one to have been observed in Queensland, was confined to the tops of maturing fruit in a two-year-old plant crop field. At the time the field was inspected most of the fruit had already been harvested, but of those remaining, between one and two per cent. were affected with the disease, mostly to an extent which rendered them valueless. In Hawaii, yellow spot affects young plants which have been propagated from tops to an even greater extent than it does the tops of maturing fruit. However, no top plants of a susceptible age were located in the vicinity of the affected plant crop field in the Mary Valley and it is not yet known to what extent the disease may affect young plants under Queensland conditions.

Description of the Disease.

The progressive stages in the development of yellow spot disease have been described by Illingworth[2] as follows:—"The first appearance of the disease, the so-called "initial spot," is a slightly raised yellowish spot on the upper surface of the leaf. It varies in size from $\frac{1}{8}$ to $\frac{1}{2}$ inch in diameter. When fully developed, the darker centre is surrounded by a halo of yellow (Plate 263, fig. A.). Ordinarily, only one leaf is affected, but as many as five initial spots have been found on a single

* Pineapple growers are requested to maintain a careful lookout for plants or fruit affected with disease symptoms resembling those described in this article. In particular, plantings made from tops should be kept under close observation. Plants or fruits suspected of being affected with yellow spot disease should be forwarded to the Department of Agriculture and Stock for examination in order that data may be obtained regarding the distribution of the disease in this State.

plant. When the spot makes its appearance it is 3 to 8 inches from the base of the leaf. This is due to continued basal growth during the fairly long incubation period. After infection takes place in the axillary region (white tissue) of the leaf, ten days to two weeks must elapse before the yellow spot is apparent. The rate of growth of the individual plant determines the distance up the leaf at which the initial spot appears. All the evidence goes to show that the insect infection takes place near the centre of the plant or top, since the initial spots appear on the leaves of the third or fourth whorls from the centre.

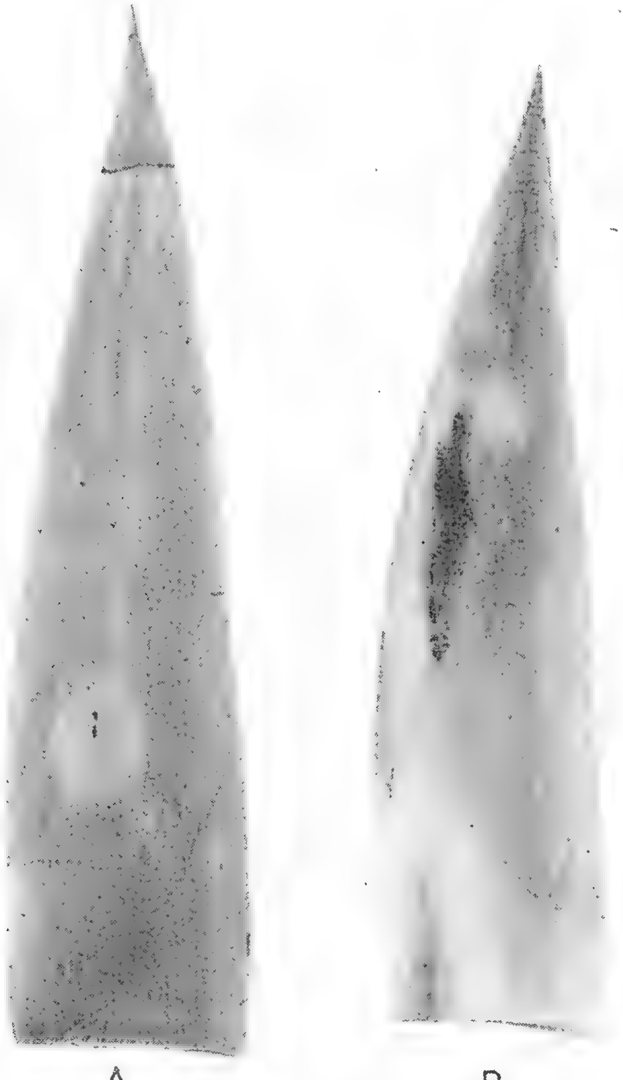


Plate 263.

Fig. A.—Early symptom (initial spot) of yellow spot disease on a leaf taken from an infected top. Note the characteristic halo.

Fig. B.—Yellow spot symptoms on a leaf produced above the "initial-spot" leaf. Note the typical chlorosis and the brown necrotic streak extending towards the base of the leaf.

"Under favourable conditions, a yellow streak develops directly below the initial spot, widening in the region of the white tissue at the base of the leaf. The tendency of this streak is to become constricted into circular yellow blotches, giving it the appearance of a chain of beads. These usually start an inch or more below the initial spot. After

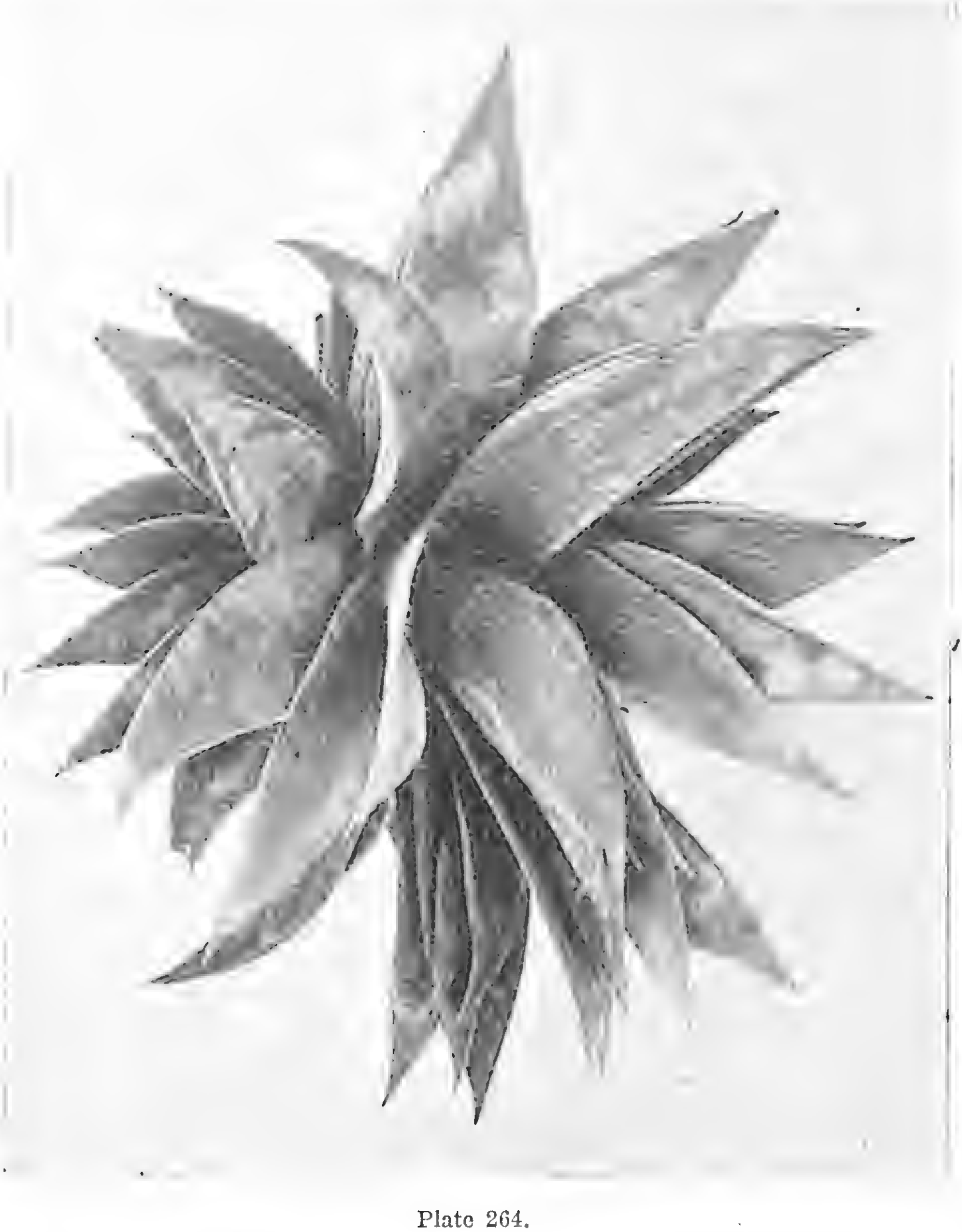


Plate 264.

Yellow spot symptoms on a pineapple top. Note the chlorotic areas and the bending over of the central leaves towards the infection point.

a few days the portion of the streak in the white tissue at the base of the leaf has a water-soaked appearance. In the presence of moisture in the leaf axils, rot soon follows, extending to the stem. A few days later a yellow streak, developing into the characteristic bead-like chain,

can be observed extending up the next leaf above the one first affected. This usually spreads quickly to the other central leaves . . . . (Plate 263; fig. B.)

"At the point where the base of the young plant (or top) is affected, the tissue ceases to grow. The normal development of the healthy tissue on the opposite side soon causes the plant (or top and fruit) to bend over very decidedly (Plates 264 and 265). This led to the name 'side rot' first being used to designate the trouble."

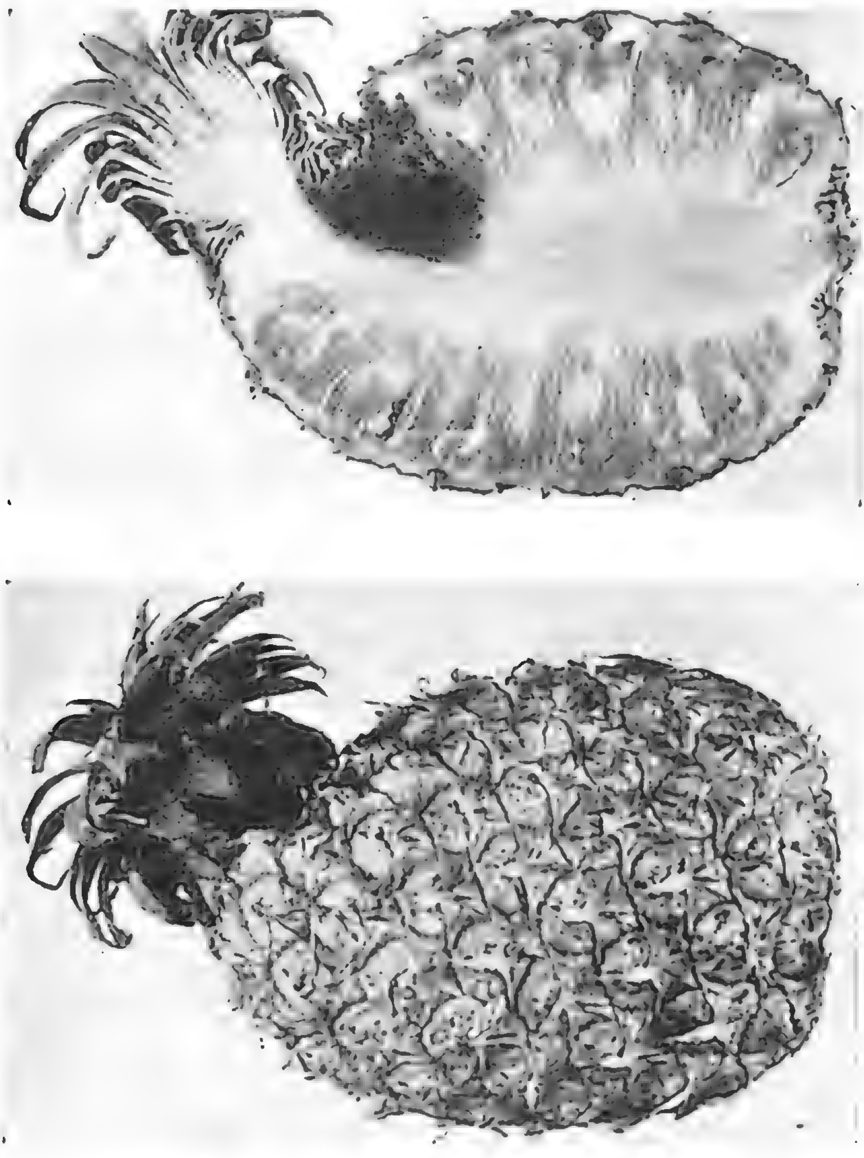


Fig. 1. Fig. 2.

Plate 265.

Fig. 1.—A smooth Cayenne fruit affected with yellow spot. Note the characteristic lop-sided development of the fruit. Fig. 2.—Fig. 1 cut lengthwise to show the extent of the injury which the disease has caused in the fruit tissues. Note that the point of infection was at or near the base of the top.

If weather conditions remain favourable, a plant or top affected with yellow spot eventually rots and dies. Depending on the age of the plant, the succulence of its tissues and on seasonal conditions, this may take anywhere from two weeks to two months from the time the initial symptoms of the disease make their appearance. If tops become affected while they are still attached to the fruit, further progress of the disease may be arrested by cutting them off at the first appearance

of infection. If the causal agent of the disease invades the fruit, the tissues of the core and adjacent fruitlets break down and a brown rot develops.

Infection may also occur in a flower or young fruitlet in the same manner as in a young plant or the crown of a fruit.[6] This type of infection is usually confined to two or three adjoining "eyes" on one side of a fruit; in many cases only a single "eye" will be involved. Cessation of growth in the infected region results in an uneven rate of development on opposite sides of the fruit, causing it to bend over towards the point of infection. (Plate 265.) In the advanced stages of the disease, the affected tissues may dry out, leaving a cavity. The destruction of the diseased fruit tissues is frequently accelerated by saprophytic organisms such as species of *Penicillium*, *Fusarium*, and *Saccharomyces*. In Hawaii, this phase of the yellow spot disease is known as the "Kauai disease," since its symptoms bear a close resemblance to those recorded by Lyon for a disease of pineapple fruits which appeared on the island of Kauai in 1915.[4]

In Hawaii, heaviest losses from yellow spot disease occur in young plantings of tops (crowns), and also in fruit which have been rendered valueless through infection of their apical tissues from affected tops. Illingworth considered that the reason why plantings of crowns are more susceptible to yellow spot than those of slips or suckers was because the looser structure of the former affords the disease-transmitting insect easier access to the tender white tissue in the leaf axils where infection occurs. Other investigators, however, express the opinion that the greater susceptibility of young top plants to the disease is due to the comparatively greater succulence of their leaf tissues during the early stages of growth. In this connection it is interesting to note that while plants grown from tops—and to a lesser extent those grown from slips—are most susceptible between the ages of three and nine months, those grown from suckers are rarely affected with the disease at any stage of their growth.

The Role of *Thrips tabaci* L. in the Transmission of Yellow Spot.

Like bunchy top of banana, yellow spot of pineapples is a virus disease which is spread from plant to plant through the agency of an insect. As previously mentioned, the insect vector for yellow spot disease is *Thrips tabaci* L., commonly known as the onion thrips. This minute insect has a world-wide distribution, and is known to attack a wide range of both crop and weed plants. On the pineapple plant it causes mechanical injury to the white tissue at the base of the leaves, not only through feeding, but also by puncturing the epidermal layers with its ovipositor. However, the ill-effects arising from these injuries are negligible unless the insect inflicting them is infective with the yellow spot virus. In this latter case, the initial spot from which the disease takes its name will appear around or adjacent to the injury in about twelve days from the time the injury was inflicted. Ovipunctures occur as minute brown dots; they do not always occur within the yellow spot itself, and generally there are none at the centre of the spot. On the other hand, a feeding injury usually extends as an irregular brown line directly through the centre of an initial spot.

Linford,[3] who has made a very thorough study of the transmission of the pineapple yellow spot virus by *Thrips tabaci*, has found that the insect transmits the virus to and recovers it from several other plants in addition to the pineapple. The most important of these,

because of its wide distribution and the fact that it is a favoured host of *Thrips tabaci*, is the weed known as *Emilia sagittata*. On this plant the disease produces symptoms which involve, in addition to mottling, a distinct tendency towards ring spot, with zonate, circular, chlorotic patterns strongly suggestive of the disease as it occurs in the pineapple. A species of *Emilia* closely related to the one which occurs in Hawaii, as well as other weed hosts of the virus, notably *Sonchus oleraceus*, the sow thistle, are widely distributed in the pineapple districts of Southern Queensland, and this considerably complicates the problem of control in these areas. Up to the present, however, symptoms suggestive of yellow spot disease have not been found on any of the plants, other than the pineapple, which have been recorded as hosts of the virus in Hawaii.

The yellow spot disease may be transmitted from plant to plant through the agency of a single insect; the larger the number of infective individuals, however, the greater is the number of plants or fruits which are likely to become infected. All thrips which feed on a diseased plant may not become infective. Linford has shown that while larvæ become infective after feeding on a diseased plant and that while these individuals remain infective throughout their entire life cycle, thrips which feed on diseased plants for the first time during their adult stage never acquire the power to transmit the virus. Before a thrips larva can transmit the infection, however, approximately ten days must elapse from the time that it first fed on a diseased plant. This period closely approximates to the total duration of the larval stages of this insect.[5]

It is not yet known whether species of thrips other than *T. tabaci* may transmit the disease, but in Hawaii it is considered that this species is the chief vector, since it is the one most commonly observed on weed hosts of the virus.

Climate in Relation to the Occurrence of Yellow Spot Disease.

Climatic conditions play an important role in determining the severity of occurrence of yellow spot disease in pineapples. Even after the initial spot makes its appearance, further progress of the disease is influenced greatly by weather conditions. Humid conditions hasten the development of the disease, while prolonged dry weather retards it. In Hawaii the disease occurs chiefly during the winter and spring months, i.e., the rainy season.[2] New infections are rarely encountered during midsummer, but they usually begin to appear again in young plantings about December (early winter). Following the discovery of the disease on the island of Oahu in 1926, it spread gradually to other islands of the Hawaiian Group, the last island on which it made its appearance being Kauai, in 1930. At the present time the severity of the disease is much worse on this lastnamed island than on any of the others, and this appears to be related in part to the fact that climatic conditions on Kauai are considerably cooler and wetter than elsewhere in the group, due to its more northerly latitude. Next to the plantations on Kauai, those on the uplands of Oahu are affected worst. On Lanaii and Molokai, where the plantations are chiefly located in low-rainfall areas, the disease is of little consequence.

Insufficient data is available to indicate the probable effect of Queensland climatic conditions on the seasonal incidence of the disease, or the extent to which it may develop under these conditions. However, in view of the fact that spread of infection from the only outbreak

of yellow spot which has yet been recorded in this State appeared to have been arrested some time previous to the beginning of October, it seems likely that, as in Hawaii, development of the disease will be markedly retarded during prolonged dry periods.

Plate 266.

Control of yellow spot disease by removal of tops from maturing fruit. Photograph taken in Hawaii on the island of Kauai, June, 1936.

In Hawaii, a very definite relationship appears to exist between the incidence of yellow spot disease and the direction of prevailing winds.[2] Plantations situated on the leeward side of affected pineapple fields or weed-infested areas are likely to suffer severely from the disease during their early stages of growth, particularly if tops are used as planting material.

Control Measures.

Complete eradication of yellow spot disease from an infected area does not seem to be a practical possibility, since some of its weed hosts are able to exist for long periods in a diseased condition and thus provide

continuous sources of infection. As Linford[3] says:—"Were it not for *Emilia* and other hosts of the virus, the pineapple yellow spot might be self-exterminating, since the pineapple plant affected with yellow spot soon dies. Consequently, transmission of the virus in diseased planting material within an infected region is not of serious importance and roguing is not needed as a control measure. Dead and dying plants are removed from fields simply to make space for replants. It is the movement of infective thrips from other hosts of the virus that accounts for the appearance of this disease in the pineapple."

Owing to the practical difficulties involved in controlling yellow spot by (*a*) elimination of the sources of infection or (*b*) destruction of the transmitting insect, reliance has to be placed on other methods of crop protection. It has been found that losses of young plants from this disease may be reduced to negligible proportions by planting only slips or suckers, while fruit losses may be avoided by cutting off infected tops as soon as the first symptoms of the disease appear in them. (Plate 266.) These are the only methods of control which are being employed in Hawaii at the present time.

Carter[1] has reported that it is possible to obtain a marked reduction in the incidence of the disease in young pineapple plants by frequent applications of tobacco dust. This reduction is believed to be due to changes induced in the plant as a result of the tobacco dust applications, since it was observed that these applications retarded and toughened the growth of very young plants. Since there appears to be a definite relationship between succulence of growth and susceptibility to yellow spot disease, Carter considers that retardation of growth is primarily responsible for the control achieved by tobacco dust applications. He points out, also, that if this conclusion is valid, then it must be remembered that a good many other factors might retard plant growth in the early stages with a similar effect on susceptibility. However, in view of the proved effectiveness of the simple measures already described, the use of tobacco dust for the control of yellow spot does not appear to be either necessary or economically justifiable at the present time.

With the discovery that *Thrips tabaci* was the transmitting agent of the yellow spot virus, the research organisation of the Hawaiian pineapple industry immediately gave attention to the problem of controlling the disease by biological means. Insect parasites of thrips have been introduced into Hawaii from a number of other countries, but as late as 1936 none of these had become established to an extent where they could be regarded as an appreciable factor in the control of yellow spot disease.

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Little Leaf of the Apple.

A PROGRESS REPORT.

R. B. MORWOOD, M.Sc., Research Officer.

A DISEASE of the apple referred to as little leaf or rosette was recorded from the Stanthorpe district in 1928. At that time only a few isolated trees were affected, but a few years later it had assumed serious proportions and has been spreading with ever-increasing rapidity. The symptoms correspond to those of the disease described as little leaf from the States of California and Washington in America and from South Africa. The response to zinc treatment reported below establishes the identity of the Queensland disease with that responding to similar treatment overseas.

Symptoms.

The symptoms of little leaf are most conspicuous in the spring, when abnormal growth develops from the top buds of one or more leaders. The development of small leaves and short internodes results in rosettes occupying the place of normal shoots. The colour of the foliage is considerably lighter than that of healthy leaves, and mottled chlorosis of fully developed leaves is frequently associated. Little leaf buds burst later than normal ones and only develop slowly, in fact the season's growth may be barely measurable in severe cases. In the early years of attack on a tree there occurs an apparent recovery with the second burst of growth which normally occurs in apples at Stanthorpe in December or January. At that time a bud below the terminal rosettes develops and grows strongly for the remainder of the growing season. If, however, the leader is cut to this growth at the following pruning, then it develops little leaf in the next season, and a continuation of this policy results in progressively weaker growth and shorter leaders. In severe cases growth practically ceases and a small misshapen tree bearing little or no fruit is the final result. Prior to the appearance of definite symptoms little leaf can sometimes be detected by the cessation of growth of leaders on otherwise vigorous trees.

Young or old trees appear equally liable to the disease, but it is most readily recognised on vigorously growing trees where marked differences between healthy and affected portions occur. On non-vigorous trees the normal small size of the leaves and shortness and thinness of internodes exists in all gradations, and in its extreme form is difficult to differentiate from little leaf.

At Stanthorpe little leaf is primarily a disease of apples, though similar symptoms have been observed in isolated cases on pears and plums. The disease has been observed on a wide range of varieties, on both Seedling and Northern Spy stocks. Observational evidence is accumulating to the effect that the Delicious is somewhat more subject than other varieties and that "reworked" trees are frequently the first affected in an orchard.

Experiments on Control.

Experiments on the control of the disease were commenced in April, 1934, when soil applications of iron, copper, and zinc were tried at rates of 2, 4, and 6 lb. per tree, and cover crops were planted. The crops

failed to become established owing to adverse climatic conditions, and no results could be deduced from the soil applications either in the following spring or that of the succeeding year.

In the spring of 1935 a number of zinc triangles varying from 10 to 40 per trunk and 5 per limb were driven into six trees, and three trees were sprayed with a zinc lime spray. Although the sprayed trees made better growth, no definite results could be recorded. The zinc triangles showed little or no effect in the immediate season or that following. In the third season they were associated with a considerable degree of recovery, but the failure to keep track of several check trees in the meantime and partial recovery of others has made definite conclusions from these trees impossible.

Fig. 1. Fig. 2. Fig. 3.

Plate 267.

TIP INJECTIONS.—Fig. 1. Injected distilled water. Fig. 2. Injected 2 mg. zinc sulphate. Fig. 3. Injected major nutrient elements.

Tip Injections.

In the spring of 1936 tip injection was used for diagnosing a response to zinc. After a preliminary trial with eosin, using also a zinc, and a nutrient solution, the following method was adopted. A spur about 12 inches below the tip of a severely affected leader on a small tree was cut across and connected with rubber tubing to the bottom end of a filtering tube. The tube was supported on a stick secured to the leader lower in the tree. Twenty millilitres of the solution under test were run into the tube and the air released from the rubber tubing.

The apparatus was left till the following day, by which time the solution was absorbed. Twelve leaders were injected in four groups of three, each of which received one of the following solutions:—

(A.)	Zinc sulphate	1 gram
	Distilled water	10 litres
(B.)	KNO_3	1 gram
	$MgSO_4$	0·5 ,,
	$NaCl$	0·5 ,,
	KH_2PO_4	0·3 ,,
	K_2HPO_4	0·27 ,,
	H_2O	10 litres
(C.)	Distilled water.	

Fig. 1.

Fig. 2.

Plate 268.

LITTLE LEAF ON LALLA APPLE.—Fig. 1. Tree healthy after spraying with zinc-lime. Fig. 2. Unsprayed tree affected with little leaf.

Two months later a small but distinct response to the zinc treatment could be noticed. Buds which had produced only small rosettes were renewing growth on all four shoots injected with the zinc solution. In only two instances (one water and one nutrients) could any growth be detected from the other injected shoots, and this growth was smaller than that with zinc. In the spring of 1937 healthy vigorous growth was produced from two of the zinc injected shoots, the other two showing fair growth. All of the other injected shoots produced only small rosettes (Plate 267).

Spraying Experiments.

Following the initial indications of response to zinc injections, zinc sprays were again tried using an autumn application of 10 lb. zinc sulphate and 5 lb. hydrated lime to 100 gallons of water. An average of $\frac{4}{5}$ of a gallon per tree was applied to medium-sized trees. Each plot contained six Lalla and six Jonathan apple trees, and four replications of sprayed and unsprayed trees were used. The Lalla trees were seven years old and particularly vigorous, except that about half of the trees were showing early symptoms of little leaf. The Jonathans were less vigorous, and, in fact, some of them were making very little growth, and consequently little leaf was more difficult to determine with certainty and only a few of the trees were recorded as affected. The sprays were applied on the 1st April, 1937.

Fig. 1. Fig. 2. Fig. 3.

Plate 269.

LITTLE LEAF SPRAYING EXPERIMENT.—Fig. 1. Leader showing typical little leaf symptoms. Fig. 2 Healthy leader. Fig. 3. Leader which had little leaf in previous season showing recovery after spraying with zinc-lime. Note weak growth for previous year comparable with that of leader in Fig. 1.

Results.

The following spring growth showed obvious differences between sprayed and unsprayed plots in the rows of vigorous Lalla trees in which little leaf was evidently spreading (Plate 268). The sprayed trees were invariably making healthy growth, only portions of the trees most severely affected in the previous season not showing complete recovery (Plate 269). In the unsprayed plots, trees previously diseased showed more severe symptoms, and many trees previously healthy had developed

a considerable degree of little leaf. Counts were made of the number of leaders on each tree showing definite little leaf symptoms on the 15th October, 1937. The results in the Jonathan row were not so definite, but the figures suggest a degree of control from the use of zinc spray. In Table I. the average number of affected leaders per tree is given for each variety in each plot, and in Table II. the figures refer to trees grouped according to the severity of the disease in the previous season.

TABLE I.
APPLE LITTLE LEAF. AVERAGE NUMBER OF AFFECTED LEADERS PER TREE.

Variety.	Treatment.	Block I.	Block II.	Block III.	Block IV.	Average.
Lalla	Sprayed	0	0·8	0	1·5	0·6
Lalla	Unsprayed	2·8	6·8	11·5	8·2	7·3*
Jonathan	Sprayed	0·7	0·2	0	0·3	0·3
Jonathan	Unsprayed	0·7	0·5	1	4	1·5

* Differs significantly from sprayed.

TABLE II.
AVERAGE NUMBER OF AFFECTED LEADERS ON THE TREES WHEN THE LATTER ARE GROUPED ACCORDING TO THE SEVERITY OF THE DISEASE BEFORE SPRAYING.

Variety.	Treatment.	SEVERE.*		MODERATE.		SLIGHT.		HEALTHY.	
		Number of Trees.	Leaders affected per Tree.	Number of Trees.	Leaders affected per Tree.	Number of Trees.	Leaders affected per Tree.	Number of Trees.	Leaders affected per Tree.
Lalla ..	Sprayed	2	3	3	1·6	3	1·0	16	0
Lalla ..	Unsprayed	2	14	3	11·0	9	7·9	10	4·4
Jonathan ..	Sprayed	0	—	1	2	8	0·4	15	0·1
Jonathan ..	Unsprayed	0	—	0	—	3	0·6	21	1·8

* Extent of little leaf prior to spraying.

Discussion.

The results recorded can be supported by observations of trees where zinc sprays have been tried by orchardists, and the response to zinc treatment is considered to be definitely established. The best method for the application of zinc is still in doubt, as is also the period for which one application will protect the tree, and extensive experiments to elucidate these and other points are being carried out by Mr. K. M. Ward, Assistant Research Officer. In the meantime a consideration of the serious effect on the trees of even one year's delay in the application of control measures would warrant orchardists applying the method which has shown best commercial results to date. This is the application of a zinc lime spray to the trees when in full leaf. The zinc lime spray is made up by dissolving 8 lb. of commercial zinc sulphate in about 70 gallons of water and adding 4 lb. of hydrated lime dissolved in 4 gallons of water while stirring. The mixture is then made up to 80 gallons and is ready for use.

Acknowledgments.

In addition to the assistance received from other Departmental officers, it is desired to acknowledge facilities and help provided by Mr. W. Long, Glen Niven, and by the late Mr. and Mrs. A. H. Paget and Mr. W. Paget, the Summit.

Summary.

The symptoms of little leaf of the apple as it occurs in the Stanthorpe district are briefly described.

Affected trees show a beneficial response to zinc treatment.

Foliage spray with zinc lime 10–5–100 has given commercial control in one experiment.

GROW MORE PASSION FRUIT.

There is a very much greater demand for passion fruit, both locally and for export, than Queensland produces, and as this State grows a passion fruit of the very highest quality, it should be produced to a greater extent than it is. As an occupation on the orchard it is one of the most pleasant. Previously production of this fruit has been undertaken chiefly as a sideline only—a kind of secondary affair which, if it yielded a return, so much to the good; if it didn't, well, it did not matter a great deal. The ever-expanding demand warrants its being made a practical crop and being subjected to kind treatment.

Vines are prone to several diseases which, with proper attention, can be controlled, but which, when the vines are allowed to grow uncared for, quickly destroy them. Due to these diseases and the haphazard method of cultivation frequently employed in the past, the idea has become current among orchardists that vines can be grown only for about two, or at most three years. That this is erroneous is being demonstrated at the present time by vignerons who have made passion fruit growing their main occupation, and who have vines bearing well at seven years of age. These growers, however, prune correctly, and spray at the correct times as advised by the department. They also grade and pack their product for market, and the result is that they are reaping the benefit of an excellent monetary return.

It is stated by some that passion fruit growing entails too much work pruning and spraying, and that the results are not worth it. A careful analysis of the position will refute such statements. Pruning the vine undoubtedly is a tedious and lengthy operation. Spraying also is objectionable, but it should be remembered that citrus growers, grape growers, and practically all other fruit growers must also prune and spray their trees. So far as returns are concerned, good vines produce up to half a bushel of fruit per year. They are usually planted 15 feet by 8 feet apart, or 363 vines per acre. Prices vary from 22s. 6d. per half-bushel during the periods of scant supplies to 4s. 6d. per half-bushel paid by the local factories. From these figures orchardists can estimate for themselves the likely returns. On a conservative average of 3s. 6d. per half-bushel clear of marketing expenses, the return would be £63 per acre per annum. Are there many other fruit crops netting orchardists this sum per acre?

Briefly, for the guidance of those who may be considering planting, it should be remembered that the passion vine is a climber, and thrives in warm, moist situations, preferably in the coastal districts. It grows well on the coastal highlands, like the Blackall Range and Tamborine Mountain, and also on the lowlands between these and the sea. The vine will resist light frosts, but heavy frosts will cause damage.

Reasonable fertile scrub and forest loams, provided they are well drained, are suitable soils, and if a hillside site is chosen it should be well sheltered from heavy winds and preferably have an easterly or north-easterly aspect. It is important that the trellises be strongly made, and that they be at least 6 feet in height.

Two crops are borne each year, a summer and a winter crop, whilst occasionally intermediate crops are borne.

Spring is the best time to plant, though autumn planting is sometimes practised. Spring planted vines sometimes return a small crop the following winter, but the first main crop can be looked for twelve to fifteen months after planting. With autumn-planted vines the first main crop often is not obtained until eighteen to twenty-one months after planting.

A pamphlet giving full cultural details is available free on application to the Department of Agriculture.

Sown Pastures and their Management.

C. W. WINDERS, B.Sc.Agr., Assistant Research Officer.

[*Continued from p. 596, Part 5, Vol. XLVIII.—November, 1937.*]

Part VI.

ANNUAL WINTER FODDER GRASSES.

Oats (*Avena* spp.).

Origin and Distribution.—The various types of oats are native to countries bordering the Mediterranean, but many of the varieties used in Queensland have originated in Australia from imported varieties. The Sunrise oat was selected from a field of Algerian oats (from Algeria) growing in Victoria, and Buddah, Mulga, and Belar oats are selections from Sunrise made in New South Wales. Oats are grown for grain, hay, and grazing in a large number of countries, and have been a favoured grazing and green feed crop in Queensland for many years.

Description.—The oat plant is a tufted, erect, annual plant in which the number of tillers and the nature of the stems, leaves, and seed-head vary with the variety.

Climatic Requirements.—Oats are a winter-growing crop, but by conservation of summer rainfall in the soil and by the use of selected varieties the crop can be grown in many areas with a fairly low winter rainfall.

Soils.—A wide range of cultivated soil types is suited to oat growing. Even fairly wet and sour soils will yield fair crops.

Planting.—Oats are best sown in the autumn, the actual time of sowing depending on weather and soil conditions, the variety to be grown, and the purpose for which the crop is sown. For hay, green fodder, and grazing purposes the late-maturing Algerian oat has in the past been the most popular oat in Queensland, but a range of equally good types is now available. The following are some of the recommended varieties:—

Algerian.—Because of its late-maturing habit, this variety is not quite suitable for dry districts. Where the winter and spring rainfall is satisfactory, Algerian is valuable for hay, green feed, or grazing. It recovers quickly after cutting or grazing, but the young growth is somewhat unpalatable to stock. Early autumn sowing is recommended. In habit it is high-tillering, strong-strawed, and narrow-leaved. It is very susceptible to smut and rust.

Sunrise.—This selection from Algerian oats is very suitable to Queensland conditions. It is particularly useful on the coast because of its resistance to rust. Sunrise is a good grazing oat, and is also valuable for hay and silage. When growing rank it is liable to lodge.

Mulga.—For grazing purposes Mulga is useful for producing an early green feed, but it does not recover well from grazing, and in addition has a short growing season. If a succession of sowings of oats is being made, a late autumn sowing of Mulga will provide a good deal of feed in early winter. It is susceptible to rust.

Belar.—This is a tall, early-maturing oat with wide leaves, and is a good hay and grazing variety. It recovers well after grazing.

Buddah.—This is a tall, sparsely-tillering variety producing a limited bulk of feed. It is not a good grazing variety.

When oats are sown for grazing purposes a sowing rate of 1 to 1½ bushels per acre is recommended. If the crop is to be cut for green feed and not grazed, ¼ to ½ bushel of field peas of the Dun, Grey, or Partridge varieties should be sown in conjunction with the oats to provide a richer feed.

Sowing through the grain drill, the seed being covered to a depth of 1½ to 2 inches, is the best method of planting. Some of the grain runs must be stopped up in order to sow at the required rate. If the seed is hand-broadcast, it should be scattered in the direction of the cultivator furrows and covered by a stroke of the harrows in the same direction.

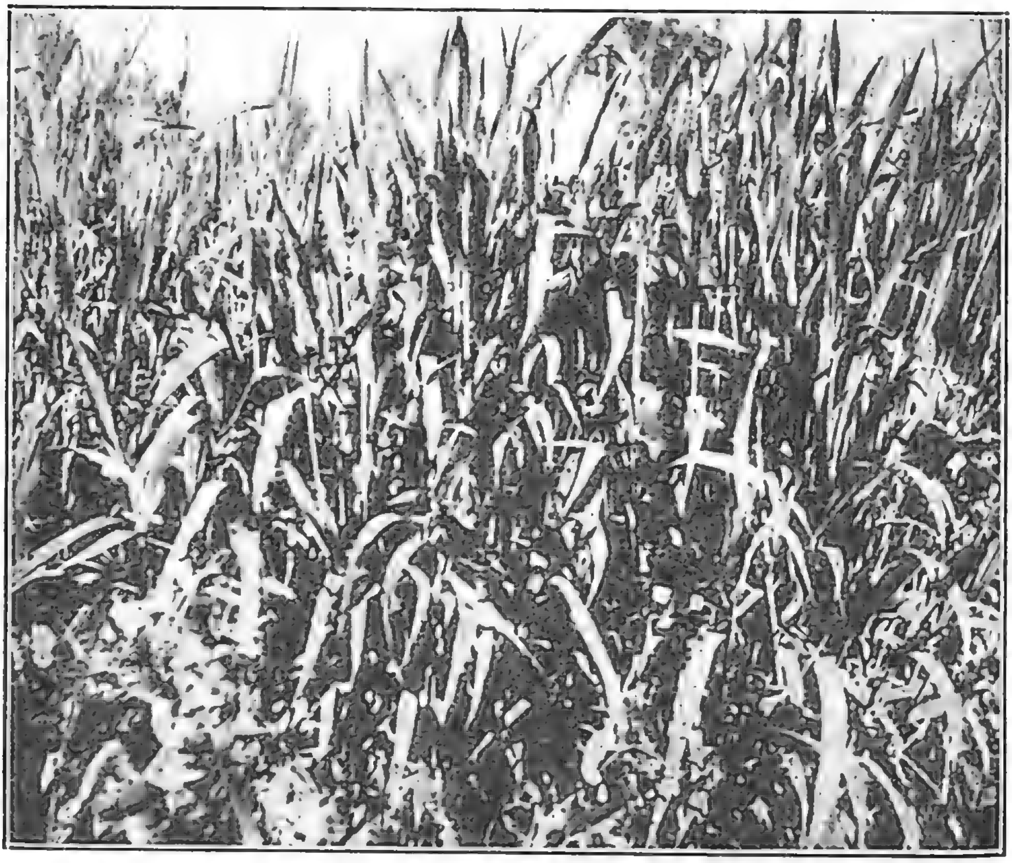

Plate 270.
Cape Barley and Field Peas.

Management.—Oats sown for grazing should not be continuously grazed, but should be spelled after each grazing to permit of recovery.

Conservation.—A hay of excellent quality can be made from oats, which also furnish a good type of silage.

Feeding Value.—Oats provide very good grazing for milking cows, as well as for fattening stock, if fed in the young stage. Towards maturity the crop loses some of its nutritive value.

Pests and Diseases.—From the grazier's point of view rust is the most serious disease of oats. In some seasons the infestation is so heavy as to render the crop useless for grazing purposes.

Barley (*Hordeum* spp.).

Origin and Distribution.—The cultivated barleys probably originated in Eurasia, where they form a valuable grain crop, and they are grown in many temperate and sub-tropical countries for malting purposes, for hay, and for pasture. In Queensland there is only a limited area grown for grain, but several varieties are commonly sown for fodder.

Description.—The barley plant (Plate 270) is quite typical of the winter cereals, being an erect, tillering, leafy annual.

Climatic Requirements.—Barley is a winter and spring grower, and requires a moderate winter rainfall.

Soils.—Various soil types are suited to barley cultivation.

Planting.—Barley should be sown during the autumn months on well-prepared land, and preferably in conjunction with a legume. A mixture of ¾-1 bushel of barley and 20 lb. of field peas or vetches is recommended. Varieties of barley suited to the district should be used.

Management.—Several grazings may be made during the season or the crop allowed to reach a more mature condition and then cut for feeding green.

Feeding Value.—The palatability and feeding value of barley are good.

Wheat (*Triticum* spp.).

Origin and Distribution.—Wheat, the world's main cereal plant, probably originated in Eurasia, but most countries of the world now cultivate the crop, and the main growing countries have produced types most suitable to their particular conditions. In addition to its use as a grain, wheat is commonly sown for grazing, green feed, hay, and silage, and grain crops are often fed off in their early stages.

Description.—Wheat (Plate 271) is an annual with a fibrous root system. It tillers fairly freely, and the erect stems bear wide leaves.

Climatic Requirements.—All Australian wheat is grown during the winter and spring months. In Queensland selected varieties may be grown in all the agricultural districts, but the chief area growing wheat for grain and other purposes is the Darling Downs. In areas with a higher winter rainfall rust infection is usually high.

Soils.—Most agricultural soils are suitable for wheat.

Planting.—When planted for fodder purposes only, wheat is usually sown in admixture with a legume such as field pea or vetch. The sowing should be carried out during the autumn or winter months, and if desired successional sowings may be made by using a series of varieties. The rate of sowing is ¾-1 bushel per acre of wheat, together with 20 lb. of legume seed.

Management.—Fodder mixtures of wheat and legumes may be either grazed or cut for green fodder. The crop should be given ample time to recover between grazings.

It is a common practice in wheat-growing areas to graze, in the early stages, stands of wheat sown for grain purposes. The stock most usually employed are sheep or dairy cows, and the grazing is carried out either as a part of the normal farm routine or else to check dense rank growth following particularly favourable growing conditions. Three important points in management of this grazing are—

(1) Grazing should not be carried out when the soil is wet.

(2) Even grazing should be effected by grazing small areas for a short time.

(3) Stock should not be grazed on the crop after the production of flowering stems has commenced.

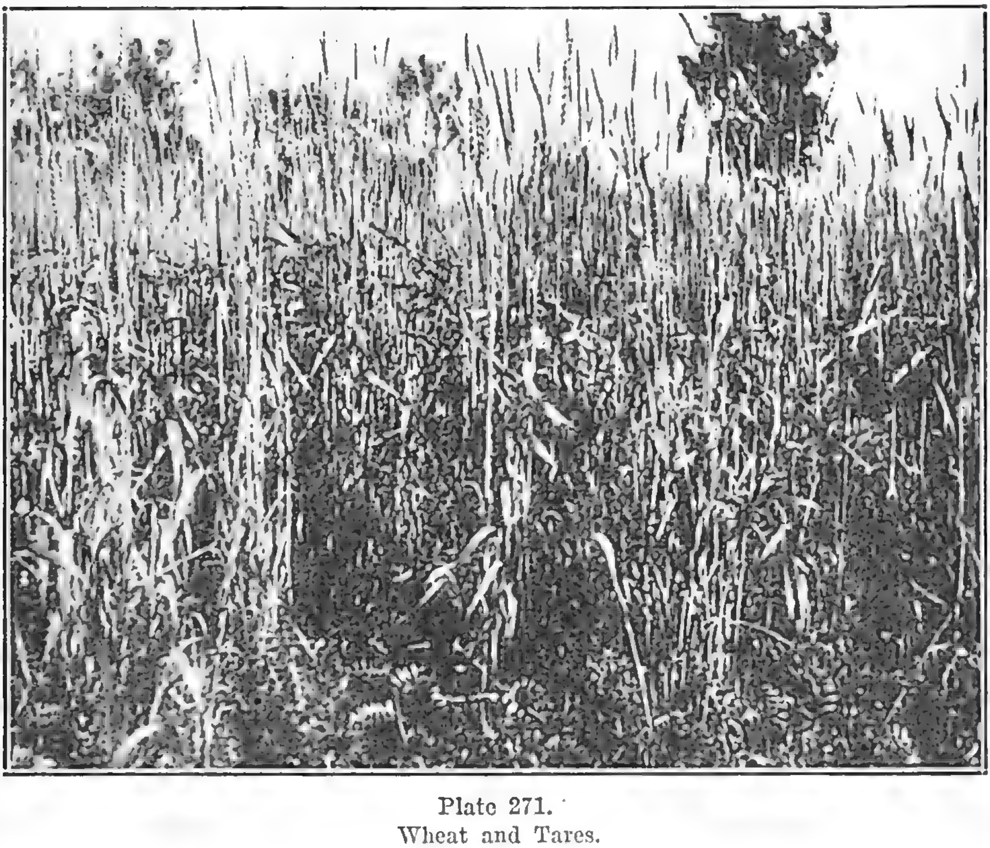

Plate 271.
Wheat and Tares.

Investigations carried out in Victoria demonstrated that grazing should be stopped immediately the first joint of the main stems produced in early spring come within reach of the animals' bite, for it is in the region of the first joint that the miniature flower head lies.

Conservation.—Wheaten hay is one of the most valuable cereal hays, and the crop is also very suitable for ensiling. The grain and offal are valuable stock foods.

Feeding Value.—The young growth of wheat is of high feeding value, and is relished by all classes of stock. The green crop is a useful feed if cut before maturity.

Pests and Diseases.—Stem and leaf rusts are common on many varieties of wheat in some seasons, and reduce the feeding value of the crop.

Rye (*Secale cereale* L.).

Origin and Distribution.—Rye is a native of Europe and Asia, where it is widely grown for its grain. In most temperate countries it is grown to some extent for grazing or green feed, but its use in Australia for these purposes is slight.

Description.—Though resembling the other annual winter cereals in habit, rye has somewhat longer stems and a more extensive root system.

Climatic Requirements.—Rye is able to thrive in cooler and drier climates than the other winter cereals. Its ability to do well under dry conditions is probably due to its root system.

Soils.—Whilst rye does well on the chief agricultural soils, it is also able to thrive on poor and sandy soils. Its adaptation to such soils has been ascribed to its deep and widely-spreading root system.

Planting.—Rye is sown similarly to other winter cereals, but should be planted early. Between 1 and 1½ bushels per acre is sufficient to sow if 20 lb. of vetch or field pea is sown in admixture.

Management.—As a pasture plant, rye is very satisfactory. It produces early winter feed, and can be grazed quite heavily.

Conservation.—Rye is occasionally used for hay and silage.

Feeding Value.—The feeding value of rye approximates that of other small grain crops.

* **Seed Canary Grass** (*Phalaris canariensis* L.).

Origin and Distribution.—The grass which furnishes the canary seed of commerce is a native of the Mediterranean region. It is fairly widely cultivated in warm, temperate countries for seed purposes, and is used in Queensland both for grain and for grazing.

Description.—Seed canary grass is an annual tufted grass with very soft leaves and a fairly shallow root system. The stems are erect and bear short, ovoid seedheads with a dense formation of flowers. The seed is light yellow in colour, hard and shining.

Climatic Requirements.—Being a winter and spring-growing annual, seed canary grass requires a winter rainfall for its best development. Once established, it is fairly drought resistant, and the climatic conditions of our main wheat-growing areas are quite suitable for its cultivation.

Soils.—The grass requires a fertile soil, such as the basaltic soils of the Darling Downs.

Planting.—The best time for sowing is during May, but sowings may be made up to the end of September. If the seed is drilled in, 8 lb. per acre is sufficient.

Management.—The crop can be grazed once or twice before permitting it to go to seed, or it may be reserved for grazing purposes. The grass is inclined to pull out by the roots if grazed too early. It should not be eaten down too closely.

Conservation.—A good quality hay can be made from seed canary grass, but other cereal hays are preferable.

Feeding Value.—The nutritive value of the grass is very good.

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* A special leaflet on the cultivation of canary seed is obtainable from the Department of Agriculture and Stock.

Italian Rye Grass (*Lolium multiflorum* Lam.).

Origin and Distribution.—Italian ryegrass is a native of Europe now grown extensively in many temperate countries, including England, United States of America, and New Zealand. In Australia it is used in the Southern States for winter grazing, and is coming into favour in Southern Queensland for the same purpose (Plate 272).

Plate 272.
Italian Rye Grass in the Caboolture District.

Description.—Though occasionally biennial in habit, in Queensland Itâlian ryegrass usually lives for only one season. It is a tufted, soft, leafy plant, tillering freely and reaching a height of about 18 in. The seeds are borne closely pressed against the slender flower stem.

Climatic Requirements.—A fairly moist winter and spring growing period is necessary for good development of Italian ryegrass. Such conditions are found only in the south-eastern part of the State, and even there not in all years. Frosts do not injure the grass, but long dry periods, particularly during the spring, give the pasture a severe set-back.

Soils.—Italian ryegrass prefers a well-drained, fertile soil, and should not be sown on inferior soil types.

Planting.—The grass should be sown in early autumn (i.e., late March or April), though sowings during May and June may be made if circumstances do not permit of earlier planting and spring feed is desired. Some farmers make a practice of scattering a few pounds of seed of the grass between the rows of the maturing maize crop at the time of final scuffling (Plate 273). The grass develops in the shelter of the crop, and when the cobs have been stripped an excellent pasture is available for grazing by stock. Most commercial lines of Italian ryegrass seed are of excellent germinating capacity and purity. The seed of Italian ryegrass is fine, and a good seedbed is desirable. Only a light covering should be made. Since the grass is an annual, only annual

winter-growing legumes or grasses should be sown in conjunction with it. Berseem clover is a good legume to use in the higher rainfall districts. Red clover makes later growth, but balances the pasture in the spring. Vetches and tares are occasionally used. The ryegrass should be sown at the rate of 15 lb. to 20 lb. per acre, with lighter sowings of the legumes (about 5 lb. of Berseem clover or 4 lb. red clover or 10 lb. vetches). Wimmera ryegrass may be substituted for portion of the Italian ryegrass in order to ensure some grazing should rainfall conditions prove just a little too severe for the latter.

Plate 273.
Italian Rye Grass in a Maize Crop.

Management.—Italian ryegrass is well adapted to grazing, but should be grazed intermittently in order to obtain best results. In favourable seasons feed will be available within eight weeks of sowing, and grazings may be made until the pasture dies off in late November or early December. The grass makes a quick recovery after grazing. Italian ryegrass sets abundant seed, and in some years seeds itself down quite effectively if the stock are removed while the seed is ripening and shedding. However, it is inadvisable to rely on self-regeneration, and provision should be made to sow the pasture afresh each year.

Conservation.—An excellent hay may be made from Italian ryegrass, and it also makes good silage if cut when some of its extreme succulency has been lost.

Feeding Value.—On account of its high proportion of nutritious leaf to stem Italian ryegrass is of excellent feeding value and palatability. It is a good fattening grass and an excellent cream producer.

Pests and Diseases.—Italian ryegrass is rather susceptible to rust attack in certain localities.

ANNUAL WINTER-GROWING FODDER LEGUMES, &c.

Field Pea (*Pisum sativum* L.).

Origin and Distribution.—The field pea is a native of Europe, fairly commonly used in many temperate countries for grazing, green feed, and green manuring purposes. In Southern Queensland it is a favourite winter green fodder crop, either alone or in combination with a winter cereal.

Description.—The plants are annual herbaceous trailers, or climbers, with hollow stems. The leaves are feather-like and bear tendrils. The flowers are reddish or purplish, and occur in groups on flower stems at the bases of the leaves. The pods contain angular, greyish seeds.

Climatic Requirements.—The field pea is a winter grower, and does best in cool, moist climates.

Soils.—Fertile soils are necessary, and they must be well drained.

Planting.—Field peas are often injured by the tramping of stock, and so are most useful for grazing purposes when sown with one of the winter cereals. About 20 lb. per acre is sufficient for sowing in mixtures. The crop should be sown in autumn.

Management.—If the mixed crop is to be grazed it should be carefully managed to avoid undue loss. Quick grazings should be made, and stock should be excluded in wet weather.

Often the mixture is cut for green feed, and this practice is usually preferable to grazing.

Bloating of stock may occur if proper care is not taken.

Feeding Value.—Field peas are very palatable to stock, and have a high feeding value.

Vetches and Tares (*Vicia* spp.).

Origin and Distribution.—Of the various forms of cultivated vetch some are natives of Europe, some of Asia, and some of the United States of America. All occur in temperate and warm temperate areas, and in these and similar areas of the world the vetches are commonly cultivated for hay, grazing, green feed, or green manure.

Description.—The vetches are climbing or trailing succulent annual plants with much divided leaves and blue, violet, or white flowers occurring in groups in the axils of the leaves. The pods are flat and contain seeds of a colour varying with the variety.

Climatic Requirements.—Vetches are winter-growing plants, and will make a fair crop on even a rather low winter rainfall. They are affected by hot weather, and die off in early summer.

Soils.—Most agricultural soils are suitable for vetches.

Planting.—Whilst they can be grown alone, vetches are better sown with some upright crop, such as one of the cereals. The mixture is much easier to harvest than the tangled mat of green stuff resulting from an unmixed sowing. In mixtures it is usual to make the cereal the main component and to sow only about 20 lb. of vetch seed in the mixture. Sowing should be carried out in early autumn.

Management.—Mixtures containing vetches may be grazed without much damage to the legume, though it is preferable to cut the fodder and feed it green to stock. When grazed, bloating should be avoided.

Conservation.—Vetches make a good quality hay if cut when in bloom or when the pods are forming, and they may also be ensiled.

Feeding Value.—The palatability and feeding value of vetches are very high.

Berseem Clover (*Trifolium alexandrinum* L.).

Origin and Distribution.—Probably this clover is a native of the Mediterranean region. It is now fairly extensively cultivated in Mediterranean countries, India, and certain parts of the United States of America and other warm-temperate to subtropical countries. In Australia it is used to some extent in the Southern States, and within recent years has come into prominence on the north coast of New South Wales. Sporadic attempts to cultivate the clover have been made in Southern Queensland without marked success, but in view of its usefulness in New South Wales, perseverance is advisable.

Description.—Berseem clover is a tufted, erect-growing annual clover somewhat resembling lucerne in appearance. The stems and leaves are very succulent. The globular flowering heads are borne at the ends of the stems and are yellowish-white in colour.

Climatic Requirements.—Since Berseem clover is an autumn and winter-growing annual, it is necessary for the clover to obtain a fair amount of moisture during the period March to August. Where the normal winter rainfall is less than 12 in. the clover should be planted only on irrigated land or on very retentive soils.

Soils.—In New South Wales the clover is reported to prefer deep clay and clay loam soils on river flats and to be somewhat less successful on red scrub volcanic soils.

Planting.—In most countries where Berseem clover is grown, it is used for hay or for cutting and feeding green. The main objection to its use for grazing is that much waste occurs owing to the trampling of the succulent parts by stock. If it is sown in pasture mixtures this objection is overcome to a large extent. A seeding rate of 8-10 lb. per acre is recommended when the clover is sown alone. In winter pasture mixtures 4-5 lb. per acre should suffice to provide useful winter grazing. Much of the Berseem clover seed on the market is imported from overseas, and frequently contains seeds of noxious weeds. Seed purchases should be submitted to the Department of Agriculture and Stock for examination, before sowing. The seed is of fairly high germinating capacity, and samples germinating lower than 65 per cent. are undesirable.

Sowing of Berseem clover should be carried out in late summer if valuable autumn and winter feed is to be obtained. Early March is, perhaps, the best time. Late autumn sowings do not permit the clover sufficient time to develop properly. Superphosphate sown with the seed will encourage the growth of the plants.

Management.—If the clover is not cut, but is grazed by stock, excessive trampling, with its consequent wastage, must be avoided by grazing off in a very few days and allowing ample time for recovery. The clover is very liable to bloat cattle. Since the clover does not regenerate itself from seed, there is no necessity to provide for seed ripening.

Conservation.—Berseem clover is reported to make excellent hay, but on the coast silage is more suitable. Mixtures of Berseem clover and oats or grasses are said to form good silage.

Feeding Value.—Palatability and feeding value are good.

Rape (*Brassica napus* L.).

Origin and Distribution.—Rape is a native of the Mediterranean region, and is used in many temperate and warm-temperate countries as an annual grazing crop for pigs, sheep, and dairy cows. It is used to only a small extent in Queensland.

Description.—The plant is naturally biennial in habit, but is usually treated as annual. It grows to a height of 2 to 3 ft., and consists for the most part of fleshy leaves.

Climatic Requirements.—Rape is most suitable for cool districts, and requires a winter rainfall for its development. Hot, dry, spring weather kills a good deal of the stand.

Soils.—A well-drained, fertile soil is required by the rape plant, and loams and sandy loams are the most suitable soil types.

Planting.—Rape seed should be sown in the early autumn on a well-prepared seed-bed. If broadcast, 4 lb. of seed should suffice for an acre. The seed should be only lightly covered.

Management.—The crop should be a foot or more tall before the stock are first put on to it to graze. When the plants have been eaten down fairly closely the stock should be removed and the crop permitted to make new growth. The succulent growth has a tendency to bloat ruminants, and appropriate precautions should be taken.

Conservation.—Rape is not a suitable crop for conservation purposes.

Feeding Value.—The succulency of rape renders it very palatable to stock. The plant has a high feeding value, especially for fattening purposes.

Pests.—Rape is rather susceptible to attack by insect pests, particularly a stem-borer and aphis or green-fly. These insects commonly destroy the whole crop, and for this reason rape is a somewhat unreliable crop to sow.

Special Feature.—Rape is sometimes used for green manure purposes.

Undesirable Features.—In addition to its bloating propensities, rape has a tendency to cause stock to scour rather badly.

CHECK LISTS OF COMMON AND SCIENTIFIC NAMES.

Within recent years important preliminary steps have been taken towards eliminating the confusion which has long existed in the nomenclature of grasses and other pasture plants. A revision of the scientific classification of British Empire grasses is in progress, and when completed will be of great benefit to those concerned with botanical names.

Similarly, a list of common names which will be accepted by the various agricultural authorities within the Commonwealth is in course of preparation, and farmers and pastoralists will assist in this movement towards uniformity if they adopt the names chosen as standard. Though the list of standard names has not yet been finalised, it is anticipated that those names used throughout the foregoing descriptions of pasture species will be accepted.

The following check lists include only the species dealt with in this series of articles:—

LIST OF GRASSES, &c., BY SCIENTIFIC NAME.

Scientific Name.	Common Name.
Grasses.	
Brachiaria mutica Stapf. (Syn. *Panicum muticum* Forsk.; *P. barbinode* Trin.)	Para grass, giant couch, panicum, Panicum muticum, Bancroft grass.
Bromus unioloides H. B. et K.	Prairie grass.
Cenchrus ciliaris L. (Syn. *Pennisetum ciliare* Link; *P. cenchroides* Rich.)	Buffel grass.
Chloris distichophylla Lag.	Tassell grass, frost-resistant Rhodes grass, winter-growing Rhodes grass, evergreen chloris.
Chloris gayana Kunth.	Rhodes grass.
Cynodon dactylon Pers.	Couch grass, Indian couch, Bermuda grass (U.S.A.), Doub grass (India).
Cynodon plectostachyum Pilg.	African star grass, budgee grass.
Dactylis glomerata L.	Cocksfoot, orchard grass (U.S.A.).
Digitaria didactyla Willd. (Syn. *Panicum didactylum* Kunth.)	Blue couch grass.
Digitaria spp.	Woolly finger and other African finger grasses.
Lolium multiflorum Lam. (Syn. *L. italicum* R. Br.)	Italian rye grass.
Lolium perenne L.	Perennial rye grass.
Lolium (?) *subulatum* Vis.	Wimmera rye grass.
Melinis minutiflora Beauv.	Molasses grass, Wynne grass.
Panicum antidotale Retz.	Giant panic grass, blue panic grass.
Panicum maximum Jacq.	Guinea grass, green panic grass.
Paspalum dilatatum Poir.	Paspalum, golden crown grass, Dallis grass (U.S.A.).
Paspalum distichum L.	Water couch, swamp couch.
Pennisetum clandestinum Hochst.	Kikuyu grass.
Pennisetum purpureum Schum.	Elephant grass, Napier fodder.
Phalaris canariensis L.	Seed canary grass, canary seed.
Phalaris tuberosa L.	Phalaris, Toowoomba canary grass.
Sorghum sudanense Stapf.	Sudan grass.
Legumes.	
Arachis hypogæa L.	Peanut.
Lespedeza sericea Mig.	Perennial lespedeza.
Lespedeza stipulacea Maxim.	Korean lespedeza, Korean clover.
Lespedeza striata Hook. et Arn.	Lespedeza, common lespedeza, Japanese clover.
Medicago denticulata Willd.	Burr medic, burr trefoil, burr clover, native trefoil.
Medicago lupulina L.	Black medic, English trefoil.
Medicago sativa L.	Lucerne, alfalfa.
Mucuna spp.	Velvet bean, Mauritius bean.
Stylosanthes sundaica Taub.	Townsville lucerne, wild lucerne.
Trifolium alexandrinum L.	Berseem clover, Egyptian clover.
Trifolium fragiferum L.	Strawberry clover.
Trifolium glomeratum L.	Clustered clover, ball clover.
Trifolium hybridum L.	Alsike clover.
Trifolium pratense L.	Red clover, cow grass.
Trifolium repens L.	White clover, white Dutch clover.
Trifolium subterraneum L.	Subterranean clover, "subclover."
Vigna unguiculata (L.) Wallp. (Syn. *V. sinensis* L.)	Cowpea, Poona pea.

LIST OF GRASSES, &c., BY COMMON NAME.

Common Name.	Scientific Name.
Grasses.	
African finger grasses	*Digitaria* spp.
African star grass	*Cynodon plectostachyum* Pilg.
Bancroft grass	*Brachiaria mutica* Stapf.
Bermuda grass (U.S.A.)	*Cynodon dactylon* Pers.
Blue couch grass	*Digitaria didactyla* Willd.
Blue panic grass	*Panicum antidotale* Retz.
Budgee grass	*Cynodon plectostachyum* Pilg.
Buffel grass	*Cenchrus ciliaris* L.
Canary seed	*Phalaris canariensis* L.
Cocksfoot	*Dactylis glomerata* L.
Couch grass	*Cynodon dactylon* Pers.
Dallis grass (U.S.A.)	*Paspalum dilatatum* Poir.
Doub grass (India)	*Cynodon dactylon* Pers.
Elephant grass	*Pennisetum purpureum* Schum.
Evergreen chloris	*Chloris distichophylla* Lag.
Frost-resistant Rhodes grass	*Chloris distichophylla* Lag.
Giant couch grass	*Brachiaria mutica* Stapf.
Giant panic grass	*Panicum antidotale* Retz.
Golden crown grass	*Paspalum dilatatum* Poir.
Green panic grass	*Panicum maximum* Jacq.
Guinea grass	*Panicum maximum* Jacq.
Indian couch	*Cynodon dactylon* Pers.
Italian rye grass	*Lolium multiflorum* Lam.
Kikuyu grass	*Pennisetum clandestinum* Hochst.
Molasses grass	*Melinis minutiflora* Beauv.
Napier fodder	*Pennisetum purpureum* Schum.
Orchard grass (U.S.A.)	*Dactylis glomerata* L.
Panicum (North Queensland)	*Brachiaria mutica* Stapf.
Panicum muticum	*Brachiaria mutica* Stapf.
Para grass	*Brachiaria mutica* Stapf.
Paspalum	*Paspalum dilatatum* Poir.
Perennial rye grass	*Lolium perenne* L.
Phalaris	*Phalaris tuberosa* L.
Prairie grass	*Bromus unioloides* H. B. et K.
Rhodes grass	*Chloris gayana* Kunth.
Seed canary grass	*Phalaris canariensis* L.
Sudan grass	*Sorghum sudanense* Stapf.
Swamp couch	*Paspalum distichum* L.
Tassel grass	*Chloris distichophylla* Lag.
Toowoomba canary grass	*Phalaris tuberosa* L.
Water couch	*Paspalum distichum* L.
Wimmera rye grass	*Lolium* (?) *subulatum* Vis.
Winter-growing Rhodes grass	*Chloris distichophylla* Lag.
Woolly finger grass	*Digitaria pentzii* Stent.
Wynne grass (Jamaica)	*Melinis minutiflora* Beauv.
Legumes.	
Alfalfa	*Medicago sativa* L.
Alsike clover	*Trifolium hybridum* L.
Ball-clover	*Trifolium glomeratum* L.
Berseem clover	*Trifolium alexandrinum* L.
Black medic	*Medicago lupulina* L.
Burr clover	*Medicago denticulata* Willd.
Burr medic	*Medicago denticulata* Willd.
Burr trefoil	*Medicago denticulata* Willd.
Clustered clover	*Trifolium glomeratum* L.
Common lespedeza	*Lespedeza striata* Hook. et Arn.
Cowgrass	*Trifolium pratense* L.
Cowpea	*Vigna unguiculata* (L.) Wallp.
Egyptian clover	*Trifolium alexandrinum* L.
English trefoil	*Medicago lupulina* L.
Japanese clover	*Lespedeza striata* Hook. et Arn.
Korean lespedeza	*Lespedeza stipulacea* Maxim.
Lespedeza	*Lespedeza striata* Hook. et Arn.

LIST OF GRASSES, &c., BY COMMON NAME—*continued.*

LEGUMES.—*continued.*

Common Name.	Scientific Name.
Lucerne	*Medicago sativa* L.
Mauritius bean	*Mucuna* sp.
Native trefoil	*Medicago denticulata* Willd.
Peanut	*Arachis hypogæa* L.
Perennial lespedeza	*Lespedeza sericea* Mig.
Poona pea	*Vigna unguiculata* (L.) Wallp.
Red clover	*Trifolium pratense* L.
Strawberry clover	*Trifolium fragiferum* L.
Subclover	*Trifolium subterraneum* L.
Subterranean clover	*Trifolium subterraneum* L.
Townsville lucerne	*Stylosanthes sundaica* Taub.
Velvet bean	*Mucuna* spp.
Wild lucerne	*Stylosanthes sundaica* Taub.

[CONCLUDED.]

KILLING JOHNSON GRASS.

Mr. W. J. McBaron (Corinda) writes in reference to an article on Johnson grass which appeared in a recent issue of the *Queensland Agricultural Journal,* in which it was stated that if the tops of the grass are kept from shooting by mowing it will be destroyed. Mr. McBaron states that he has seen the soil dug in a trench 3 feet deep, and the soil taken in a face to remove the roots; and, although there were no signs of leaves afterwards, it shot up round the treated area two years after. He also has seen the expedient of building a haystack over a clump of the grass tried, without success, inasmuch as the grass came up round and through the edge of the stack, eighteen months or two years afterwards. In the case of very heavy soil it is possible to kill the grass by ordinary methods.

Mr. McBaron states that, after a good deal of experimenting, he found only one method of combating the pest, and that was by using sodium chlorate as a spray. The destruction of the grass through this medium, however, was thorough and complete, there being not a vestige of either tops, stems, or roots—more correctly, rhizomes—remaining unpoisoned. Mr. McBaron said he had had several inquiries from persons who had seen the effectiveness of that method which he had tried when on a lucerne farm at Harrisville.

Describing this process, Mr. McBaron said two or three sprayings are needed, and from five to six months are required to kill the grass. The sodium chlorate is non-poisonous; but it has been found that clothing which has been wetted by a solution of it will burn like gunpowder when dry, and it is impossible to put it out. The clothes are safe while they remain wet.

One pound of sodium chlorate should be used to one gallon of soft water to which has been added some soap-powder, and this spray should be applied when the grass is old and in head. It is necessary that these three conditions should be observed in order to make the spray adhere thoroughly to the leaves. Spraying should be commenced as soon after Christmas as possible. If it is begun earlier than that the grass will be too vigorous, and if it started much later, there will not be time to finish the "job" before all growth is stopped by the winter. The only effects noticeable after this first spraying will be a slight withering of the leaves and a stooling out from the base. This growth must be caught with the second spraying as it comes to head; and, in a few weeks, all the roots will begin to die back, commencing with the points and the destruction of all the eyes along the roots. If the plants are let alone, it will be found that by the spring the parent stool will be dead and all the roots dried up. As a rule, no third spraying will be needed, except for the odd pieces which always are missed. Care must be taken not to overlook any of these, as otherwise all that has been done will be useless. If it is only a small patch on which the Johnson grass is growing, the seed heads should be reaped as soon as they have formed; but, if this is not done, care should be taken not to let any seedling grass get a hold in the following spring. Ordinary cultivation will kill the seedlings, as in the case of other grasses, if dealt with at an early stage.

A New Weed on the Darling Downs.

W. D. FRANCIS, Botanist.

WITHIN the last few months a new weed of the legume family has appeared on the Darling Downs in a lucerne field at Kingsthorpe. This weed has been determined botanically as *Astragalus hamosus*. This is the first record of the occurrence of a species of *Astragalus* in Queensland. The genus *Astragalus* is an extraordinarily large one, comprising over 600 different kinds or species. These species occur in different parts of the world such as Eastern Asia, Europe and North America. Among these numerous species are some notorious poisonous plants such as several of the loco weeds of North America. Wholesome species also exist. A Caucasian species (*Astragalus falcatus*) has been recommended in France in preference to lucerne for cultivation on poor dry lands.

When the specimens from the Darling Downs were provisionally determined as *Astragalus hamosus* some of them were sent to Mr. Anderson, Curator of the National Herbarium of New South Wales, for confirmation and remarks. A reply was received to the effect that this species was already established in parts of New South Wales and was spreading slowly, but that it had not so far been considered as poisonous to stock. In connection with the possible poisonous properties of this plant, it should be noted that Pammel lists it as poisonous on the authority of Greshoff, but he does not mention anything concerning its poisonous action or properties. I understand that the Veterinary Adviser of this State is taking steps to test the species for poisonous properties.

The species is indigenous to the Mediterranean Region and Transcaucasia.

Astragalus hamosus.—Usually in this plant there are a large number of reclining and partly erect stems proceeding from a common root-stock. In our specimens there are more than ten of these stems. Each stem measures from 7-10 inches long. With the possible exception of the petals and some of the inner parts of the flowers, all of the parts of the plant above ground are clothed with white hairs which are pressed to the parts on which they occur. These hairs often impart a greyish look to the plant. The leaves consist of 8-12 pairs of leaflets and a terminal odd leaflet. Each leaflet has the appearance of a small leaf. The leaves are placed alternately on the stem. Each leaflet measures from $\frac{1}{4}$-$\frac{1}{2}$ inch long and is elongate egg-shaped in outline with the apex blunt and broader than the base. The flowers are small and yellowish white in colour; they are borne in groups at the end of stalks which are situated at the junction of the leaves with the stem. These flower stalks vary from about $\frac{3}{4}$ in to 2 inches in length. The pods follow the flowers. The pods are strongly curved or prominently sickle-shaped; they measure from 1 to $1\frac{1}{2}$ inches in length and are about $\frac{1}{8}$ inch in thickness. A peculiar feature of the pods is a partition running their whole length and dividing the internal part into two cavities. The

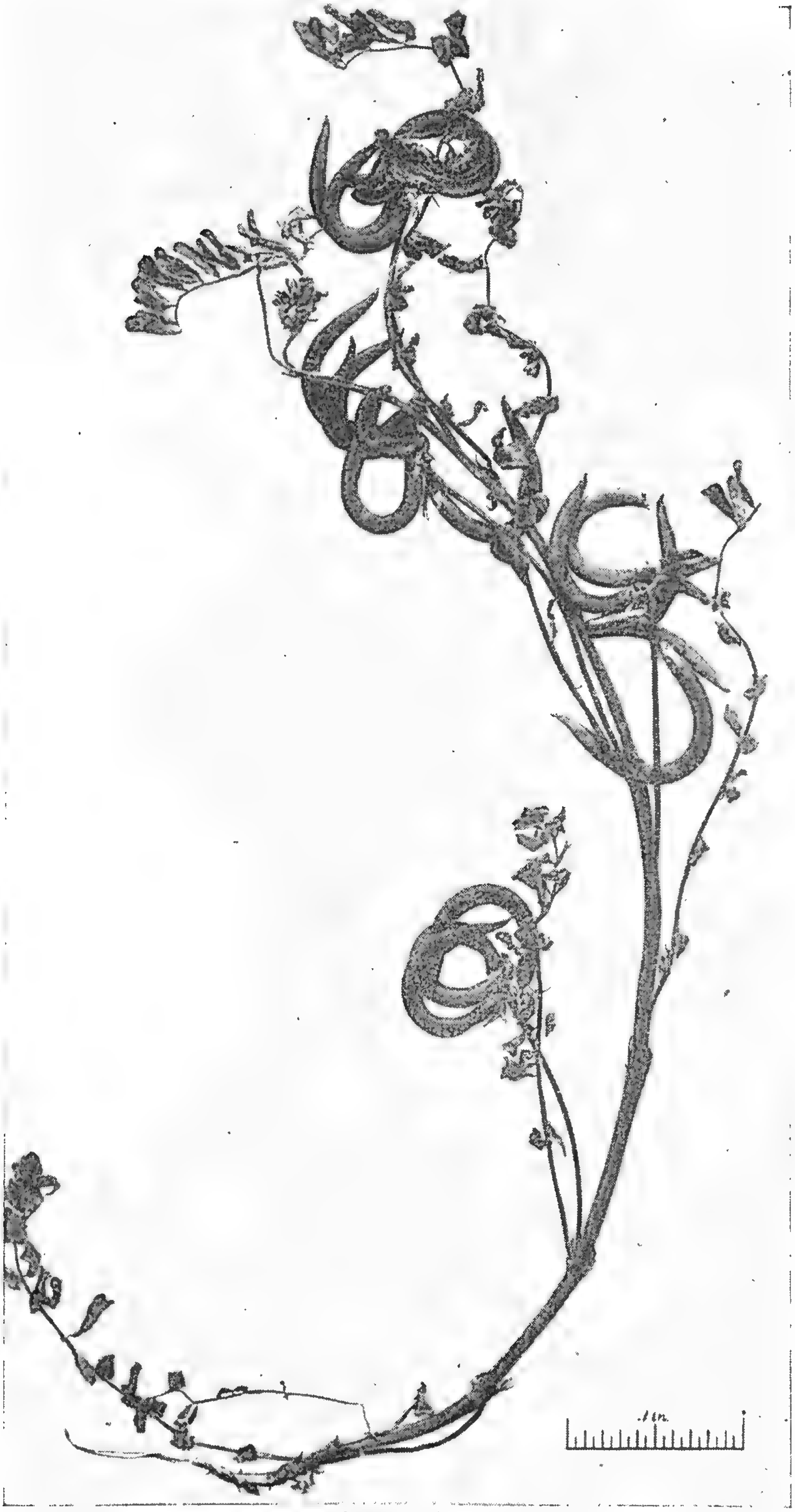

Plate 274.

A new weed on the Darling Downs, *Astragalus hamosus*. The inset scale measures one inch. Photograph from dried specimen.

[*Photo. Dept. Agriculture and Stock.*

seeds are contained in these two cavities. Each seed is smooth, peculiarly geometric (almost rhombic) in shape, and measures about $\frac{1}{10}$ inch in length.

The accompanying photograph (Plate 274) illustrates a dried specimen of the plant.

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Pammel. Manual of Poisonous Plants, p. 829, 1911.

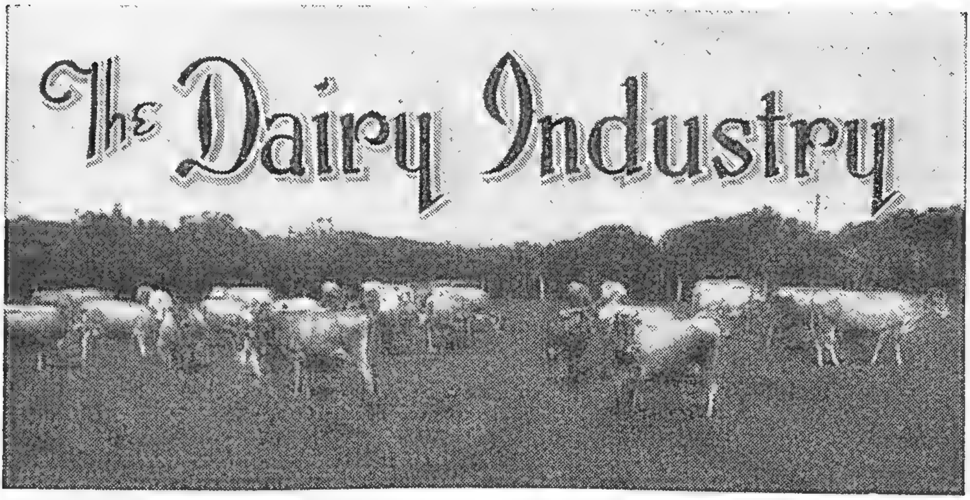
THE TAXPAYER AND THE PUBLIC SERVANT.

Many people think that the pay of every public official comes out of the purse of the taxpayer. Those people think wrongly. Many officials do not draw one penny of their pay from consolidated revenue, and are just as independent of that fund for their daily bread as are the outside taxpayers themselves. These officials, too, are not exempt from taxation which employees not in the service have to pay. Indeed, in many ways, Crown employees are much easier marks for taxation, and for the collection of taxes, than other employees. Various State Departments earn their own livelihood—some of them a good deal more; and the excess earnings go to help State activities—the education of the children of the taxpayer or the financing of loans for buildings and development. Demonstrating the contention, the State Insurance Office was established in 1916. In December, 1916, it employed forty-eight officers; its income for the year 1916-1917 was £202,569. As at 30th June, 1937, it employed 475 officers, its income for 1936-1937 was £1,406,743, and its total assets amounted to over £5,000,000. With the exception of the Workers' Compensation section, the State office, in a general way, is in open competition with public insurance companies, and has to fight and to fend for itself. It owns the well-known central building which is the hub of its operations. Thus, by keen and vigorous management and high efficiency, the State office has won for itself an honourable place in the world of insurance. It is apparent, too, that State Insurance supplied something which the public desired and has appreciated, otherwise the public would not have supported the office to the extent which it has done. And the staff and the general running expenses of this office are no more a charge upon the taxpayer than are the staff and the running expenses of, say, the A.M.P. Society. Comment on the same lines, but adapted to suit their special purposes, could be made of such self-supporting trust sections as the Public Curator's Office, State Advances Corporation (Workers' Dwellings), and the Agricultural Bank.

Employees paid from consolidated revenue numbered 27,979 at 30th June, 1937. Of these, 16,276 were engaged in providing railway service in return for fares and freights, and 750 were employed in sections which pay their way, such as the Titles Office, Machinery and Scaffolding Inspection, Government Printing Office. The remaining number of employees is 10,953, of whom 50 per cent. are in the teaching service and 25 per cent. are in the Department of Health and Home Affairs, which embraces police, prisons, asylums, and the general social services. The total annual cost of these two Departments alone exceeds the total income tax collections by nearly £500,000.

Seekers of truth may welcome these rays of light.

—*J. D. Story, I.S.O., Public Service Commissioner, in his Annual Report to Parliament.*



The Influence of Herd Testing.

L. A. BURGESS, A.A.C.I., Dairy Research Laboratory.

HERD testing is intended primarily to demonstrate to the dairy farmer the fat-producing capacity of each member of his herd. It also is of great benefit in improving the general standard of farm management. Experience has proved that better breeding requires better feeding, and an improvement in the quality of the dairy herds stimulates improvement in methods of pasture management.

New Zealand herd testing organisations have as an objective an average annual production of 300 lb. of butter fat per cow. In the Buller district of the Dominion, at least 40 per cent. of the cow population has been under test continuously since 1930. Since that year the following averages have been recorded:—

Year.	Fat per cow. Lb.
1930	230
1931	250
1932	279
1933	287
1934	297
1935	301

The Buller District Herd Testing Association has now fixed its objective at 350 lb. of fat per cow.

In the whole of New Zealand the average production per cow rose from only 127 lb. to 152 lb. between 1901 and 1919. The practice of herd testing then became more general, and in the shorter period 1920 to 1934 the average production rose from 152 to 220 lb. of fat.

In 1934, no fewer than 286,889 cows were tested for a period of 100 days or over, and their average production was 262 lb. of fat. The 1933-34 Queensland figures—29,521 cows, with an average production of 161 lb. of fat per cow—form a remarkable comparison.

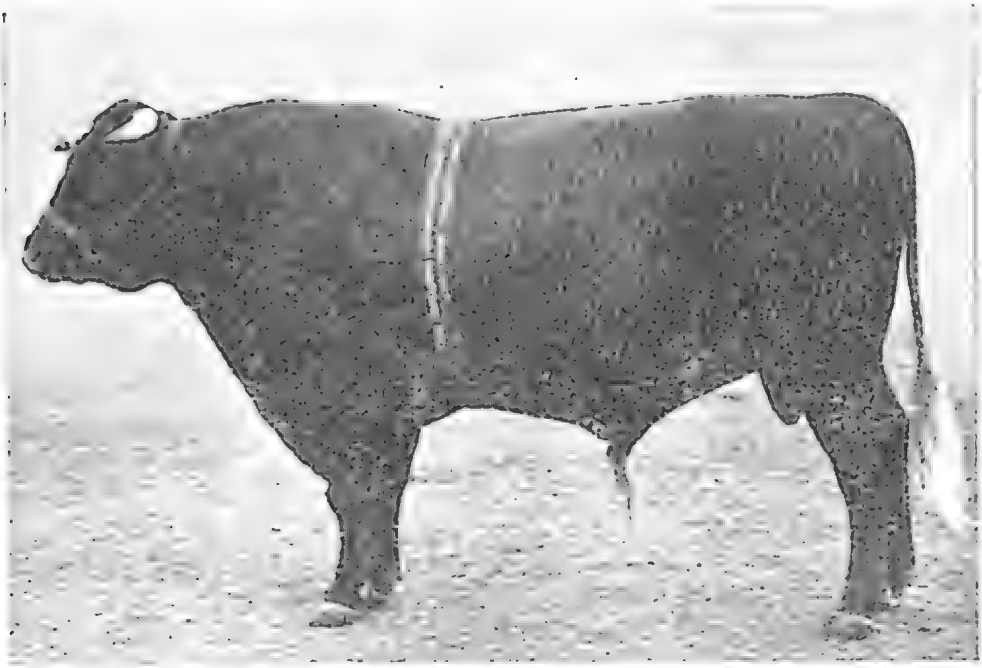


Plate 275.
BURRADALE BYRON, the 1937 Brisbane Show Champion Australian Illawarra Shorthorn bull; owned by J. Phillips.

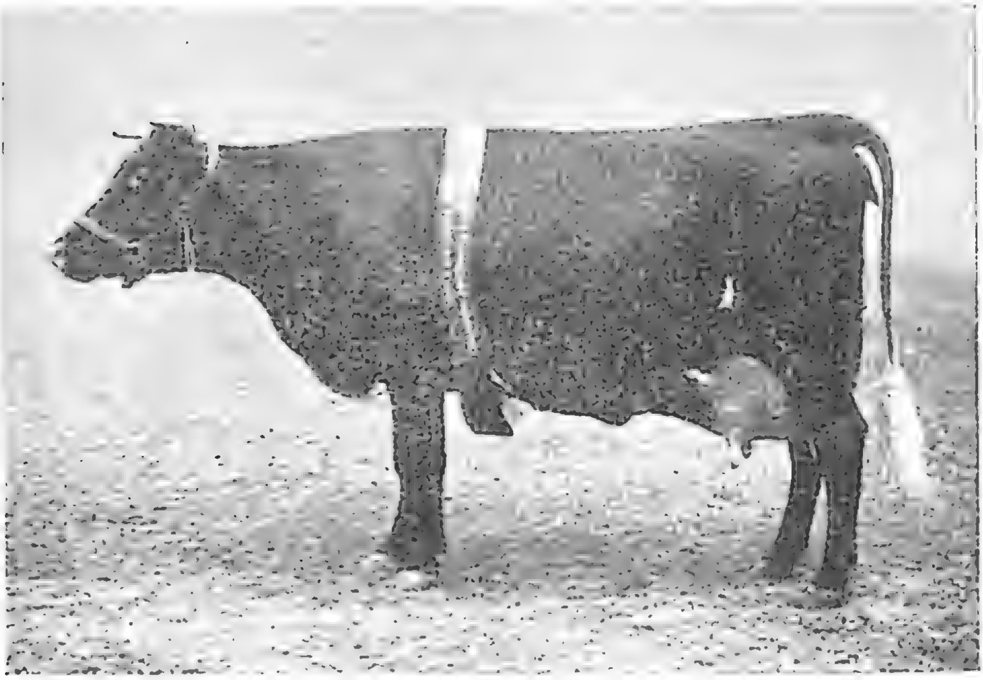


Plate 276.
MAY IV. OF OAKVILLE, the A.I.S. champion cow at the 1937 Brisbane Show; the property of G. M. Marquardt.

Plate 277.
OXFORD BROWN VICTORY, Champion Jersey bull at the last Brisbane Show, owned by Mrs. M. E. Stanton.

Plate 278.
OXFORD JOYFUL MAID, Champion Jersey cow at the last Brisbane Show; owned by E. Burton and Sons.

With the increase in production per cow came the problem of providing additional food. This was not done by bringing large areas of new land into production, but by improving pasture management. Close subdivision of paddocks, laying down of pastures of improved grasses, conservation of fodder, and the wise use of artificial fertilizers improved greatly the carrying capacity of the land. It has been stated authoritatively that the greater part of the 5,000,000 acres of dairying land in the Dominion is top dressed at least once in every three years. The Dairy Industry Commission's Report of 1934 shows that the liberal use of fertilizers goes regularly with an increased production and carrying capacity per acre, and a decreased overhead in the cost of fertilizer per lb. of fat.

Pounds of butterfat per acre.	Total fertilizer expenditure per acre. s. d.	Cows per per 100 acres.	Cost of fertilizer per 100 lb. of fat. s. d.
Under 75	5 8	29	9 11
125 to 150	10 9	52	7 10
200 to 225	14 8	71	7 0
Over 250	18 10	87	6 8

These figures were obtained by the New Zealand Department of Agriculture from a survey of over 500 farms in the North Island and, therefore, may be taken as typical.

Queensland herd testing figures for the last six years are:—

Year.	Number of cows tested.	Fat per cow. lb.
1932-2	10,383	165
1932-3	12,690	166
1933-4	29,521	161
1934-5	24,334	154
1935-6 (drought)	14,422	141
1936-7 (drought)	6,530	134

From information supplied by the Government Statistician the figures for the whole of the State are—

Year.	No. of Dairy cows.	Fat per cow. Lb.	Percentage of cows submitted to herd testing.
1931	775,301	127	1·3
1932	792,943	127	1·6
1933	877,709	127	3·4
1934	939,254	137	2·6
1935 (drought)	955,746	119	1·5

Some allowance should be made in respect of the average fat per cow taken from the Statistician's figures, as these include the production of herds which are milked only during the flush of the season and which should not be regarded as dairy herds.

Not only is the average production per cow very low, but the percentage of cows submitted to herd testing is most unsatisfactory. The average production is likely to remain low until dairy farmers take full advantage of herd testing facilities open to them, and apply more widely the principles of both herd improvement and pasture management.

Plate 279.
Golf Hill Chevalier, Champion Hereford bull at the last Brisbane Show; exhibited by E. R. Reynolds.

Plate 280.
Cootharaba Fancy IV., Champion Hereford cow at the last Brisbane Show; the property of J. J. Galloway.

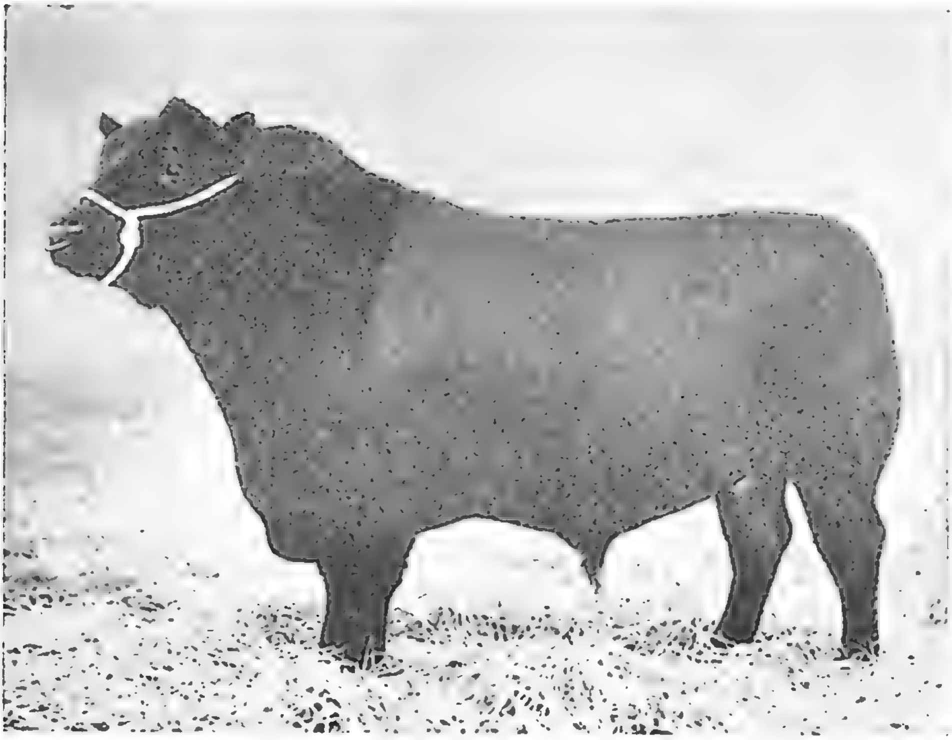


Plate 281.
Bald Blair Watt, the Aberdeen Angus bull that won the Champion Award in the last Brisbane Show; owned by F. J. White and Sons.

Plate 282.
Bald Blair Nora II., Champion Aberdeen Angus cow at the last Brisbane Show; the property of F. J. White and Sons.

Pneumonia in Swine.

JOHN LEGG, D.V.Sc., Government Veterinary Surgeon.

PNEUMONIA in young pigs is a very common disease in the dairying districts throughout the State. It appears to take on characters of contagious nature, and may spread very rapidly throughout a piggery. Once it is well established it may cause considerable losses, not only because a certain number of pigs are fatally affected, but because many of the recovered animals are left in such a state that they do not fatten and fail to reach maturity. Such pigs are commonly known as "runts" and are a distinct source of monetary loss to the farmer.

In America and Europe much work has been done in determining the exact cause of the various types of respiratory diseases in live stock. However, although the exciting causes have been discovered, it has been found that secondary factors have an influence on the development of these diseases. Little work of a similar nature has been carried out in Australia, but there seems to be little doubt that in this country, as well as in Europe and America, secondary factors are very important. These secondary factors can be summed up in unhygienic and dirty surroundings, herding of large numbers of pigs in relatively small areas, feeding numbers of pigs of various sizes and condition in common troughs, lack of sufficient exercise grounds and want of sufficient green stuff.

Generally speaking, the younger animals are much more seriously affected than the older and if the young pig contracts pneumonia in the course of the first few weeks of its life, the economic value of a litter may be reduced to negligible proportions.

It becomes necessary, therefore, to adopt all those precautions which mitigate against the spread of this disease, particularly among young stock. Isolation of the sow before farrowing and the maintainance of the litter under proper conditions during the first few weeks of life are very important. A reasonable degree of cleanliness is demanded; the

avoidance of wet cold sties, proper exercise for the mother and a properly balanced ration all help to develop a vigorous and healthy constitution in the young pig. Isolation of the young animal cannot be carried on indefinitely, but, given a good start, the young animal is usually strong enough at weaning time to resist any possible infection which it may contract when the weaned pigs are brought together for fattening purposes on the farm.

Contagious pneumonia is not, as a rule, difficult to diagnose. The young pigs are unthrifty, do not eat well and show a tendency to isolate themselves from the others. There is usually a discharge from the eyes and nose, but one of the most prominent symptoms is coughing.

FEEDING BACON PIGS.

E. J. SHELTON, Senior Instructor in Pig Raising.

Because of the conditions associated with the recent prolonged dry weather in Southern Queensland—from the effects of which the pig industry is still suffering—and of the fact that the price charged for pig foods of all descriptions is still very high, many pigs arriving at bacon factories are not in the primest of condition. When slaughtered their carcasses dress out soft, slightly discoloured, and, on grading, are classed as of other than the choicest grade; in fact, some are very fat and too heavy.

In some instances the fat is soft and oily, and in others it is of a slightly yellowish colour and will not "firm up" during the chilling process. If used for small goods, this soft, oily, discoloured meat still carries objectionable features. The loss to the industry through this trouble, plus the lower condition of many of the pigs that kill out to advantage, must be very heavy, for it is impossible to expect factories to pay top prices for second or third grade carcasses.

The Department of Agriculture and Stock, therefore, offers the following advice to farmers, especially in districts south of Rockhampton:—

Soft, Oily Pork.—Although several foods may be responsible for this soft condition, all the evidence points to the fact that the chief cause of the trouble is the feeding of peanuts or meal manufactured from peanuts to pigs which are being finished or topped up for the market. Maize and other grain foods are relatively scarce and high priced, and as peanuts produce particularly fast growth in pigs, farmers are naturally tempted to use them or the meal in place of grain. The position could be relieved if pig raisers would concentrate their peanut feeding on the breeding stock and young store pigs, which will make very good use of surplus peanuts, and then other foods available could be kept for the pigs from the store stage until they reach bacon weights. Separated milk, root crops, pumpkins, lucerne (either as green fodder, hay, or chaff), and small quantities of pollard, meat meal, and pasture can be used to make up good rations in the absence of maize.

Yellowish-coloured Pork.—It is known that the probable cause of this condition is an excess of carotin, a colouring matter in plant life, and which is present especially during the early life of the plant and at the stage when (as in the case of pumpkins) the crop is fully ripe or

over-ripe. The feeding of an excess of green wheat, oats, or barley, in the absence of, or short supply of milk may also be responsible; so also may the continuous use of grass or of lucerne as the principal food.

Low-conditioned Pigs.—Lack of condition is, of course, invariably due to lack of sufficient nutritious food. When pigs are in such a condition they become more liable to infestation by internal and external parasites, which irritate the animal and cause much restlessness, especially at night.

It is better to keep fewer animals and to feed them properly than to attempt the keeping of more than the number for which food is available. It is better, too, to market the pigs when light and prime than to carry them on to heavier weights with loss of condition. Where milk is in short supply, meat meal may be used as as substitute. In all cases, the pigs should have clean drinking water and mineral material like charcoal.

Bruised and Damaged Pigs.—Where pigs are weakened as a result of lack of condition and where they are soft in texture—the result of improper food—they bruise much more readily, and tend to be more discontented. The only way to avoid bruising is to have the animals in the primest condition (not over-fat) and to treat them kindly and not force or beat them when when loading or unloading. Avoid kicking them or forcing them through narrow gateways or over rough stony yards.

Over-fat Pigs.—Despite high-priced foods, there is still a proportion of over-fat and very heavy weight stock coming forward. Pigs should not be fed too heavily on grain, but should be kept growing and given abundant exercise in grassy pastures. It is a mistake to keep pigs penned up continuously in small sties and bare yards. The use of flesh-forming foods like milk, meat meal, lucerne, greenstuffs, &c., and mineral matters will tend to overcome any tendency to over-fatness.

HINTS ON PIG-FEEDING.

Grain feeding enters largely into successful pig raising, so that the form in which it is fed is important. Pigs which have been fully fed with corn through their growing period usually make good use of the whole grain, and corn-in-cob feeding may be adopted. Animals that are fed with corn only occasionally may not masticate it thoroughly, and a waste is incurred. For these a preliminary cracking is advisable.

Well-ground grain is fed usually only to stud animals or stock for exhibition.

The appearance of whole grain in the dung may encourage pigs to eat excreta. This is a clear-cut case for grinding.

Milling by-products are usually fine, and this may be a disadvantage when the pens are in an exposed position or during windy weather. The waste may be reduced considerably by wetting.

There is no need to prepare pumpkins or squashes, beyond the breaking of hard-skinned varieties, e.g., ironbark pumpkins.

Most tubers may be fed as harvested, or the pigs can be allowed to harvest for themselves. It is advisable to cook potato "culls."

Milk, milk products, seed cake preparations, meat and blood meals, and cereal by-products require no preliminary treatment whatever.

Lucerne or other roughages are well masticated usually by older pigs, and young pigs eat such small quantities that there is no point in chaffing.

LOSSES AMONG YOUNG PIGS.

Of all the losses with which the pig raiser has to contend, none involves such heavy financial loss as that associated with mortality in young pigs prior to the stage, and age, at which they are ready for marketing. Probably 25 per cent. of the average litter of pigs is lost before the weaning age (eight weeks), and from 20 to 25 per cent. of the remaining pigs fail to reach the market at an age at which they would return the maximum profit.

Careful investigations made in New Zealand showed that the commonest cause of loss before weaning is lack of attention at the time of farrowing, a number of pigs being suffocated at birth or killed by the sow. It was found that premature birth had caused considerable losses, while the number of still-born pigs either perfectly or incompletely developed was also considerable.

Most of these losses were considered to be due indirectly to defective feeding of the brood sow and to mineral deficiencies in the diet.

It must be remembered that pregnant sows may be underfed and improperly prepared for farrowing in several ways. Lack of succulent green food, drinking water, mineral matter, readily digestible food, and also want of exercise, are frequent causes of trouble at farrowing time. New Zealand experience was that, far from causing harm, a liberal feeding of the brood sow resulted in the production of heavier and better pigs at birth, provided, of course, the sow was active and healthy.

The remedy on many farms lies in providing necessary supplements to the food supply—such as meat meal, root crops, and plenty of milk, with the addition of mineral matter.

Strict limitation of the food supply a day or two before farrowing is necessary. Careful feeding, a clean, dry, nicely bedded pen with suitable farrowing guards, and quiet surroundings in which the sow can settle down to farrowing are very important.

Losses after weaning also are unusually heavy where improper management exists. In New Zealand it was estimated that approximately 125,000 pigs, which should be available for slaughter as porkers or baconers, die every year before reaching that stage. The period dating from the eighth to the twelfth week after birth is one of the most susceptible in the life of a pig. The system adopted should aim at feeding the young pig in such a way that there will be no check in growth prior to, at the time of, or after weaning. Care should always be exercised to minimise the shock of the change over from the sow's milk to other foods by providing, for instance, a separate pen in which the young pigs can feed apart from the sow.

The greatest check in growth results from the young pigs having to contend with older pigs at the feeding trough. Additional hindrances are overcrowding, filth, dampness, parasite infestation, and lack of clean drinking water.

—*E. J. Shelton, Senior Instructor in Pig Raising.*

A PROFITABLE SOW.

Mr. Dave Johnston, of Malanda, North Queensland, in reporting the loss of his well-known large white sow "Hillcrest Rosebud," winner of many champion prizes at Tableland and Cairns shows, advises that this sow was mated on each occasion to the large white boar "Commonwealth Candidate." Her records are as follows:—

HILLCREST ROSEBUD. Registered No. 2787.

Date of Birth of Litter.	No. of Pigs in Litter.
19th December, 1932	17
18th July, 1933	18
27th January, 1934	20
12th August, 1934	19
9th January, 1935	18
27th September, 1935	17
23rd February, 1936	12
1st October, 1936	19
4th April, 1937	15
4th October, 1937	18

To have produced that number in ten litters is a meritorious performance and again demonstrates the productiveness of the modern brood sow.

Ophthalmia of Domestic Animals.

ROSS NOTT, B.V.Sc., Government Veterinary Surgeon.

THE disease known as ophthalmia, which is an inflammation of the eye, and often is referred to as "blight" or "pink eye," affects all the domestic animals, although it probably is encountered most frequently in cattle and sheep.

The disease is contagious and is brought about by the entrance of a special germ into the eyes. Injury to the eyes such as is caused by grass seed is considered sometimes to be the sole cause of blight. This, however, is incorrect, for the true contagious form of the disease cannot be produced unless the specific germ is present. It must not be overlooked, however, that any foreign material which becomes lodged in the eyes will set up irritation and give rise to a non-contagious form of ophthalmia, and, secondly, eyes in such a condition are more susceptible to the contagious form.

The infective material which is responsible for setting up new cases is present in the discharges from the affected eyes, and frequently it is carried from one animal to another by flies. Another method of spread, particularly with sheep, is by long grass, &c., becoming contaminated with eye discharges, which are transferred later to the eyes of healthy animals grazing over the same area.

The first change noticed following infection is a watery discharge issuing from the inner corners of affected eyes. If the eyes are examined at this stage, evidence of inflammation will be seen in the form of a general reddening and enlargement of the minute blood vessels. As the disease progresses the discharge becomes more copious and full of pus, and the eye generally becomes dull. If no treatment is given, a film appears over the eye and the animal becomes temporarily or in some cases permanently blind. The film is due to an inflammation of the surface layer of cells. Frequently the case does not extend beyond this stage, and even without treatment the eyes begin to recover gradually and rturn to normal. In other cases the inflammation may extend to the deeper structures, leading to permanent blindness in one or both eyes. In those cases which recover without treatment the animals may be blind partially or totally for up to a week, and during this period they are difficult to drive and usually lose condition. Losses are also experienced through the animals becoming separated from the rest of the herd and not being able to find water.

If animals are treated in an early stage of the disease they recover quickly. Several mixtures may be used in the form of drops into the eyes, and very good results have been obtained with a 2 per cent. solution of zinc sulphate. To make this solution ½ oz. of zinc sulphate is dissolved in 1 pint of clean water, which has been boiled and allowed to cool. A 5-10 per cent. solution of argyrol also is effective. For treatment, about ten drops of one of the mixtures mentioned are dropped into each affected eye at least once, and, when possible, twice or more daily. The treatment should be continued until the eyes have returned to normal.

In the case of valuable animals the discharge should be cleaned away from the eyes with a boracic acid solution, and yellow oxide of mercury ointment (1-50) should be applied to the lids to prevent them from sticking.

As the disease is contagious and rapidly spreads from animal to animal, the affected cases, particularly when only few in number, should be isolated until they have recovered completely. Particular care should be taken when new animals are introduced to see that they are not infected, as the disease often is introduced into and spread through a flock by such means.

In the case of sheep it is wise, when facilities are available, to treat all the animals and to draft off those showing evidence of the disease for more intensive treatment in a small hospital paddock.

WOUNDS IN HORSES—SIMPLE TREATMENT.

The fundamental principle underlying all wound treatment is the provision of suitable downward drainage for the discharge from the wound. If such drainage is provided then most wounds tend to heal well, but deep wounds penetrating downwards and which form pockets do not progress satisfactorily, for the reason that pus and discharges collect within them and cannot get away. Wounds which penetrate in an upward direction need little treatment beyond ensuring that they remain open while healing from their deepest part and that they are reasonably clean on the surface. In the case, however, of downward penetrating wounds it is necessary to use a knife judiciously in order to allow the discharge a free outflow.

Before any wound treatment is attempted, the injured edges of the wound should be clipped with scissors to remove the hair and reveal the true nature of the wound. The next thing to do is to wash the wound thoroughly with a warm, weak disinfectant solution. Then, if necessary, the depth of the wound can be explored with a blunt probe which has been boiled, or with the fingers after the hands have been thoroughly washed and scrubbed. Punctured wounds—such as nail or stake wounds—are always difficult to drain and often have to be opened up. Microbes are carried in when the foot is punctured, pus of a black liquid and foul smelling nature may gather in the foot, and may continue to accumulate because it cannot drain away. If that happens, acute lameness is certain to follow. If unattended, these corrupt fluids rise slowly above the level of the horn and eventually break out through the soft skin over the coronet; but by that time the structures within the foot are in a nasty mess and the case has become very serious.

To treat hoof punctures, the whole foot is cleaned and, if possible, it is held in a bucket of warm disinfectant solution to still further cleanse it and also soften the horn. The sole of the foot is then pared away by making a cone-shaped hole at the point where pain is most acute. The apex of the cone must be carried right through the horn until blood or pus is revealed. The pus should then be allowed to drain away. To prevent the hole from closing, a pad soaked in a solution of iron perchloride should be placed in the wound and the treatment should be repeated daily while necessary. If treated thoroughly in the way described little further attention is necessary.

CARELESS BRANDING.

Slovenly methods in the branding of stock, particularly cattle, are in evidence far too frequently, the results being most undesirable in many respects. Quite often the carelessness with which the branding irons are applied involves cruelty, although it may be unintentional.

It is cruel to hold the hot iron on an animal until the skin is burnt through, and it cannot be justified on the score of necessity. This practice may be due to underheated irons, but, on the other hand, it may be due to over-hot irons held on the skin a fraction of a second too long, or with too much pressure. Such branding causes blotches, and very often the actual letters or figures are undecipherable. The skin in the area involved is ruined for tanning purposes, and festering sores may result. Identification of the animal by means of such a brand is rendered very difficult, if not impossible.

It is a well known fact that, on large stations, where thousands of calves are branded yearly, and where speed is a factor in the handling of large mobs, the standard of branding is much higher than on some small holdings—such as farms, where only two or three calves may be branded at irregular periods.

Castration of Colts.

W. DIXON, Inspector of Stock.

THE best time of the year to perform this important operation is the spring, when rain has fallen and green feed is available, and before the hot weather has set in.

The colts to be gelded having been yarded over night, it is desirable, before proceeding with the operation, to take precautions against losses through infection of wounds. Crude carbolic acid or phenol in a solution of 7 oz. to 1 gallon is a suitable disinfectant, and should be sprayed over the ground and rails of the yard.

All instruments used should be sterilized by boiling for at least ten minutes, and should be wrapped in a sterile towel and kept in a box at the yard until required.

After each colt is done the instruments and hands of the operator should be washed in a weak solution of carbolic acid, this solution being kept in a separate vessel, and only sufficient for each disinfection being poured into a dish for the purpose, and then thrown away. The practice of using a petrol or kerosene tin filled with disinfectant to wash instruments and hands time after time is risky.

For unbroken colts, the rough and ready methods of roping, choking, and throwing as practised on many stations may cause the loss of valuable animals. These losses may be minimised if a crush with side gates is available, so that the colt can be haltered and side lines used on him before the gate is opened to cast him.

The colt, having been cast on his left side, the hind legs drawn up to the shoulders and made fast with half hitches, the fore legs can now be secured with the knees bent to the hind feet.

The scrotum, sheath, and penis should be washed with warm water and soap, care being taken to remove any suety deposit from the penis and the cavity at the end of the penis. The left or lower testicle (the colt being on his left side) is seized in the left hand, and pressed until the skin is tight over it; a bold incision from front to back, parallel with the median line is now made, penetrating the outer skin and the tunica, laying the testicle bare. As the incision is made, the cord should be grasped firmly in the left hand to prevent the retraction of the testicle upwards through the canal. When this happens it is sometimes difficult to recover, and the subsequent manipulation in an attempt to bring it down delays the operation, and causes unnecessary shock to the patient. The knife is now slipped between the anterior and posterior portions of the cord, and the latter (posterior), which the muscle retracts, is cut completely through.

The testicle now lies inert, connected by the anterior portion of the cord, whih is composed of blood vessels, and should be drawn out until it is taut, without using force, when the emasculator (if that method is being used) should be used close to the belly, with a slow squeezing movement, taking care that the crushing part is nearest to the belly, and the cutting part to the testicle. The cord should be severed as short as possible, so that it may not hang below the wound, and so cause complications.

The other testicle may now be removed in a similar way.

It is advisable to swab the wound with a solution—1 to 2,000—of chloride of mercury. The ropes may now be removed, and the colt allowed to rise and walk out of the yard, so as to be away from dust.

If the operation has been performed carefully, and all antiseptic precautions taken, recovery should be rapid and no further treatment is necessary, but if undue swelling is noted, the wound should be opened with the fingers, after washing the hands with carbolic solution, so that there may be free drainage, and the wound swabbed with disinfectant.

Some bleeding always occurs, but rarely lasts for more than half an hour, but if copious bleeding persists after that time—as is the case when emasculators have been used carelessly—the cord must be found, and the artery tied with silk thread. If the stump of the cord cannot be found, the canal should be plugged with pledgets of tow or wool soaked in muriate of iron of the same strength as obtained from the chemist, which helps to form clots, and so closes the artery.

LAND FOR GRAZING HOMESTEAD SELECTION.

A resumption from Evesham holding has been surveyed as portions 5, parish of Montford, and 3, parish of Worcester, and will be open for grazing homestead selection at the Land Office, Longreach, on Tuesday, 18th January, 1938.

The portions are situated 3 miles westerly and 20 miles south-westerly, respectively, from Morella railway station on the Longreach-Winton railway.

The areas of the portions are 19,557 acres and 29,380 acres.

Each selection will be for a term of twenty-eight years and the annual rent for the first period of seven years is 2¾d. per acre.

Each selection must be stocked to its reasonable carrying capacity with the applicant's own sheep during the first three years.

The portions are watered by sub-artesian bores and tanks. They comprise open pebbly and brown soil downs, lightly to moderately shaded, well grassed with Mitchell and Flinders grasses, and are good wool-growing and fattening country.

Free lithographs and full particulars may be obtained from the Lands Department, Brisbane, the Land Agent at Longreach, and the Queensland Government Tourist Bureaux, at Sydney and Melbourne.

NEATSFOOT OIL KEEPS HARNESS IN GOOD ORDER.

For keeping harness in good order, neatsfool oil needs no recommendation to farmers.

Neatsfoot oil is made by boiling in a suitable receptacle the feet and leg bones (up to the knees) of well-grown cattle. The material should first be thoroughly cleaned by scalding and scraping it free from hair, dirt, &c.; it should then be covered with water, which should be brought to the boil and then allowed to simmer for about two hours. After the oil has risen to the surface it should be skimmed off and the mixture boiled again, and a second skimming made.

The oil thus secured should be strained through a piece of cheese cloth, in order to remove pieces of flesh, &c., from the mixture, and the strained product should then be boiled again, great care being taken that it does not catch fire. Finally, it should be strained again, cooled, and bottled. Pure neatsfoot oil should be light lemon in colour.

The method described is for manufacture on a small scale. Manufacture for trade purposes necessitates the use of a much more detailed and tedious process.

Breeding Fowls for Egg Production.

J. J. McLACHLAN, Poultry Inspector.

IN breeding poultry the farmer should exercise the utmost care in order to establish and maintain a high-quality flock. The progress made in the past has been considerable. Egg production has been increased from about 60 eggs to over 200 eggs per bird per annum, many individual pullets laying over 300 eggs in a year.

In dealing with egg-production in a flock of birds consisting of an equal number of pullets and hens, many authorities quote 12 dozen as a fair average annual production. It is doubtful, however, whether there are many poultry farmers in Queensland who obtain an average production per bird of less than 13 dozen eggs yearly. In some experiments conducted at the Animal Health Station, using White Leghorns purchased from a poultry farmer as day-old chickens, the average production over the two years was 181 eggs per bird, the variations being—pullet year, from 194 to 209 eggs; second year, from 155 to 162 eggs. There were 116 pullets used in this experiment and it will be noticed that the average of the two years was over 15 dozen eggs, and even these birds in their second year laid over 13 dozen. These birds were kept under poultry farm conditions.

The poultry farmer should be able to obtain an average production at least equal to those figures. A constant high average production is only obtainable by good breeding in conjunction with good management and feeding.

The chief considerations in arriving at the standards of good breeding are:—Type, constitutional vigour, action, and laying characteristics. Having selected birds that are reasonably true to type, care must be taken to see that they are of strong constitutional vigour. This is indicated by the vitality, stamina, health, brightness, and alertness of the bird, and is of equal importance to the knowledge of the actual number of eggs laid. As an example, some years ago the first three birds in a laying test laid 302, 296, and 294 eggs respectively. An examination of these birds at the conclusion of the test showed that the first and second birds were weak in constitution, whereas the third bird was very strong. All these birds were used as breeders, but while the progeny of the first and second hens were disappointing layers, the descendants of the third bird have performed very well in laying tests every year since. That example should emphasise very clearly the necessity for rejecting birds that are weak constitutionally.

Admittedly it takes courage not to breed from a 300-egg bird. If such a bird produced the eggs without a heavy drain on her body she would be constitutionally strong. If, however, the bird rapidly loses condition during the year, she is obviously weak in constitution and consequently would probably be an indifferent breeder. Any bird that is unable to stand up to a heavy season's laying without losing condition cannot be expected to give high-laying progeny and should be discarded irrespective of other characteristics.

Points for Poultry Breeders.

J. J. McLACHLAN, Poultry Inspector.

THE poultry farmer, in selecting birds for breeding purposes, should reject any bird which does not measure up satisfactorily in constitutional vigour, irrespective of other considerations.

A strong bird has adequate size, is well-fleshed, with prominent eye, full face, a sprightly carriage, and is very alert and active.

Although there actually is no egg-laying type of bird, there are some very definite laying characteristics which are valuable in the selection of birds for either breeding or production. For instance, capacity is essential to permit of the necessary expansion in the reproductive organs of a hen. The ovary develops from about the size of a two-shilling piece to approximately the full circumference of a teacup, and the oviduct from about 9 inches long and $\frac{1}{2}$ inch wide to about 18 inches long and $1\frac{1}{4}$ inches in width. In addition to this it may be mentioned that a laying fowl consumes more food than a non-layer: thus the intestines would contain more food. A bird should have a long, deep, wide body, or, in other words, capacity.

The head is another valuable guide, particularly in respect to health. The face should be full, red in colour, and fairly free from feathers. Sallow or sunken-faced birds should be avoided. The eye should be full, round, bright, prominent, and expressive.

Strict attention should be paid to the colour of the eyes, particularly with breeds that should have red eyes, as there is a tendency for such breeds to have greenish-coloured eyes. Birds with green or light-coloured eyes are prone to become short-sighted and even go blind early in life. The skull should be strong but fine, and birds with overhanging eyebrows should be avoided.

The plumage of the birds, as it walks around the pen, should be examined, and careful notice taken as to whether the plumage fits close to the body or is loose and fluffy. As the tight or close-feathered bird usually is a better layer than the loose-feathered bird, it is only natural that only the former should be bred from. To the inexperienced person the contrast in feathering is more easily noticed in heavy breeds such as Australorps than in White Leghorns.

The thickness of the shanks is a good guide with respect to the coarseness or fineness of the bone. A coarse-shanked bird is a coarse-boned bird, and generally a poor layer. A layer-breeder has fine shanks, and the undersized bird, as a general rule, has over-refined or spindly shanks.

Any bird which is a known layer of small eggs should be passed over. As far as is possible only birds which lay eggs slightly above 2 oz. in weight should find their way into a breeding-pen.

Special care must be given to the selection of the male bird. All the features mentioned regarding type of females apply also to males. An active, alert bird should be selected, as such males will give better fertility and stronger chickens than will dull, slow birds. Young males can be mated with more females than older birds. Twenty females

can be mated with a White Leghorn cockerel and sixteen females with an Australorp cockerel, if in each instance a vigorous male is used.

Male birds, the sons of known producers of large eggs, are most valuable, as the characteristic of production is transmitted from the hen, through her son, to her granddaughters.

Should pullets be used as breeders? is a question that is frequently asked. The answer to that is that if they are fully matured and up to standard in respect to type and size, and produce eggs of the recognised weight of 2 oz., they should be equal to older birds as breeders. Why object to breeding from pullets and at the same time use cockerels for mating purposes? It must be admitted, however, that where records are kept of egg production, breeding from hens which are heavy layers has proved more profitable than breeding from pullets, which more or less are an unknown quantity.

Plate 283.

[*Photo. P.E.I. Branch.*

On the Road to Kirrama State Forest, North Queensland.—This new road gives access to hitherto untapped timber lands in which Kauri pine and other cabinet woods abound. It is one of the several large forestry road projects in progress in the Far North, the work of the Public Estate Improvement Branch of the Lands Department.

Summer Cultivation.

DURING early summer the soil should be kept free of weeds and the surface loose. For this purpose it is a very common practice to make frequent use of cultivators.

The cultivator certainly covers the area rapidly and is useful in quickly checking evaporation by breaking up a crust formed after rain, but there are objections to its too frequent use. The surface soil becomes too fine, which prevents subsequent rain from freely percolating through it, and thus much of the moisture flows away or is evaporated instead of soaking in, and if much flowing occurs surface soil is also carried away. The fine soil also becomes easily caked even by small falls of rain, and the mulch is, therefore, easily destroyed, and in showery weather requires very frequent renewal. Constant use of the cultivator also forms a sole pan; thus as the season progresses the mulch becomes more shallow and, consequently, less lasting, while the sole pan also prevents free percolation of rain or artificially applied water, which means further loss by evaporation or actual flowing away.

The plough, on the other hand, leaves the surface in a condition which allows the rain to percolate more freely and forms a more lasting mulch, as it is not so easily destroyed by light rains; the plough, moreover, is more efficacious for keeping down weed growth. Weeds are not harmful until their roots have extended through the mulch and are drawing on the moisture below, but if one is depending on the cultivator to keep them down they must be dealt with while they are far smaller than if one uses a plough.

Summarised, the arguments for greater use of the plough for summer cultivation are that a more enduring mulch is obtained, weeds do not require such frequent attention, water is enabled to percolate more readily, and loss of surface soil is reduced. It is only fair to state that heavy rains, which will destroy the mulch, may occur soon after the use of the plough, and in such cases the advantage of the more lasting mulch is lost; however, this does not always occur, and the other disadvantages remain. The cultivator should be looked upon as a quick

substitute, and should be used chiefly when it is desired to check immediate evaporation, and the work should be more thoroughly carried out with the plough later as time permits.

One objection to the use of the plough for summer cultivation is that it upsets the levels of the land. This is of greater importance where irrigation is practised. The drawback can be minimised, if not wholly overcome, by using a plough with the mouldboards removed.

Plate 284.
A Wheat Crop at Columboola.

It is sometimes argued that it is risky to use a plough among deciduous fruit trees during their active period on account of injury to the roots. Undoubtedly, by the careless use of the plough damage can be done, but though it may not be so discernible, careless use of the cultivator can also cause root injury. Moreover, because the plough maintains a deeper mulch throughout the season, as already mentioned, the trees are prevented from forming roots too close to the surface. The greatest risk of serious root injury occurs when the later winter ploughing is delayed until the trees are active in the spring—feeding roots are disturbed just when there is heavy demand on the trees by blossoming and fruit setting.

FERTILIZER FOR STANDOVER CANE.

It is well recognised that a two-year-old crop of cane possesses the virtues of an early-maturer, in that it possesses a high sugar content early in the harvesting season. Indeed, it is often found that such a crop tends to over-maturity as early in the harvesting season as August, and any grower who has much of this class of cane to harvest is advised to take steps to offset the disadvantage of having too much mature cane early in the season.

A very simple means is at the disposal of the grower, and the following method is recommended to all farmers with stand-over cane. It has been proved that sulphate of ammonia both improves cane yields and delays maturity. Therefore, an application of even one bag of sulphate of ammonia per acre, applied in the spring, to one-year-old cane, will assure a vigorous second-year growth and delay the maturity of the crop sufficiently to enable it to be harvested when just mature. Cane at the peak of maturity always gives the best returns to the farmer.

—H.W.K.

Save P.O.J. 2878!

THIS appeal is directed to cane farmers in Southern Queensland, particularly in the Moreton area, where the variety P.O.J. 2878 is giving such remarkably good results, especially as a standover cane. P.O.J. 2878 was introduced into Queensland in 1928 during the search for suitable gumming disease resistant varieties. Experimental tests soon established the fact that it possessed very high resistance to gumming and mosaic diseases, the then chief diseases of the South. Farm trials followed and these demonstrated the great value of this cane as a farm

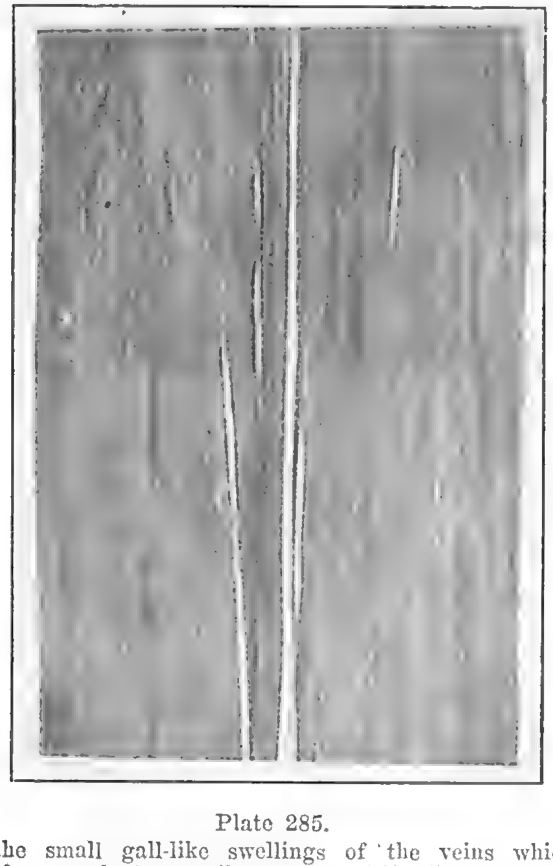


Plate 285.

Illustrating the small gall-like swellings of the veins which occur on the under surface of leaves of plants affected with Fiji disease. One long gall may be seen in the centre, running the whole length of the photograph; the smaller galls scattered over the leaf are of the size most usually seen. This leaf is reproduced at natural size.

cropper. Its vigorous growth, resistance to drought and wet conditions, strong ratooning, and the gumming resistance which enabled it to be stood over to make rapid second year growth, all combined to recommend it to the farmer. From the farmer's point of view the variety has, in fact, only one really serious drawback in Southern Queensland and that is its susceptibility to Fiji disease. P.O.J. 2878 contains $\frac{1}{8}$ "wild blood"; it is this wild blood which confers the resistance to gumming and mosaic diseases but, unfortunately, at the same time confers susceptibility to Fiji disease.

Plate 286.

An advanced stage of Fiji disease attack on a growing stalk of cane. The leaves have become stiff, stunted, and misshapen, and the top looks as though it had been chewed by some animal; such leaves bear on their under surfaces galls of the type pictured on page 714. At this stage all further growth has ceased and the stalk dies before long.

Fiji disease is common in parts of the Maryborough area and P.O.J. 2878 is a disapproved variety there in consequence. The disease is not very prominent as yet in the Bundaberg-Isis, Bauple and Moreton districts, but it has spread in the past few years and constitutes a continuous menace to the successful cropping of P.O.J. 2878, especially on irrigated and river flat lands. It is true that up to the present the damage in the Bundaberg-Isis, Bauple, and Moreton areas has been almost negligible; obviously, *now* is the time to take precautions. Even if unchecked spread were allowed to take place the total damage in two-three years' time might still be comparatively light *but by then it will have become difficult to obtain reliable disease free plants and trouble will be right on the doorstep.* Once that stage is reached the days of P.O.J. 2878 will be numbered.

Plate 287.

The two small grass-like stools in the foreground are the result of ratooning diseased stools. The planting of infected cuttings yields a similar type of plant. Variety P.O.J. 2714, all stools nine months old.

Fortunately, if the required small amount of care is exercised now, while the amount of disease is small, the menace may be held in check. A reading of the following notes should enable any farmer to recognise the disease when he sees it and to take the necessary simple measures for its control.

Symptoms of the Disease.

Fiji disease appears to have originated in New Guinea but first came into prominence in Fiji, where it caused havoc about the beginning of this century. The earliest symptom, and the peculiar characteristic of the disease, is the production of small yellowish galls on the under surface of leaves of diseased cane (see Plate 285). These galls may vary from one to many per leaf; they are formed by the enlargement of the veins of the leaf and might be pictured as a sort of varicose vein; they are usually 1-32 to 1-16 inch in diameter and range from ½ to 2 inches in length. In the later stages of the disease the leaves become

Plate 288.

Clustered stool is often seen in some of the P.O.J. canes and resembles the grass-like shoots of one stage of Fiji disease (see Plate 287). It can readily be distinguished from Fiji disease by the fact that no small galls are borne on the under surface of the leaves.

shortened and erect, very stiff and brittle, and take on a darker green colour. In this stage the cane top often looks as though it had been eaten by some animal (see Plate 286); no further growth now occurs, the leaves become smaller and smaller and eventually the heart dies.

When diseased setts are planted, or when diseased stools are ratooned, the resultant plants are always diseased and in most cases produce no cane but remain a cluster of grass-like shoots (see Plate 287). An examination of the under surface of these small leaves will show the presence of the small leaf galls described above (refer to Plate 285 again).

The freak known as "clustered stool" (see Plate 288) may be confused with Fiji disease at times. Occasionally some varieties, and particularly some of the high numbered P.O.J. canes, fail to produce a normal stool but give rise to a cluster of grass-like shoots (campare with Plate 287). This condition is due to "sporting" and it may easily be distinguished from Fiji disease by the absence of any small galls on the under surface of the leaves (see Plate 285).

Spread of the Disease.

Experiments carried out some years ago by Messrs. Bell and Mungomery proved that Fiji disease is spread from plant to plant by a small brownish insect, about $\frac{1}{5}$ inch in length, known as the sugar cane leaf-hopper. The insect absorbs infected juice when feeding on diseased cane and then injects it into the next healthy cane on which it feeds.

After the leaf-hopper has infected a new plant there is a lapse of time—sometimes months—before the symptoms appear. Consequently it is impossible to be certain of selecting all healthy plants from the healthy-looking plants in the vicinity of diseased cane.

The leaf-hoppers become much reduced in numbers during winter and spring and usually do not increase greatly in numbers until about December, reaching their greatest numbers about February. It naturally follows, therefore, that spread of the disease is most rapid in the wet season months and least during winter and spring.

Control of the Disease.

In those districts where this disease occurs the following rules should be carefully carried out:—

1. Plant only disease free cane, taken from disease free farms, when susceptible varieties are planted.

2. Inspect all young plant and ratoon cane at regular intervals and dig out any suspicious looking stools. Since the leaf-hopper becomes very scarce during winter, and remains so until about December, the inspection of fields and digging out of diseased stools should be completed by November-December.

3. Do not continue to ratoon diseased crops.

4. The better the conditions for cane growth the better are conditions for the spread of Fiji disease. Therefore, special care is necessary on rich alluvial land or irrigated farms.

5. Where the disease has become established, resistant varieties should be planted in neighbouring fields. P.O.J. 213, P.O.J. 234, Co. 290, Q. 813, Korpi and Oramboo are resistant; H.Q. 285 (Milton) and Mahona are also resistant but are susceptible to gumming disease. P.O.J. 2714, P.O.J. 2725, P.O.J. 2878, 1900 Seedling and D. 1135 are susceptible.

6. Keep a watch on neighbouring fields; Fiji disease is just as dangerous when on the next farm as when on your own farm.

7. Procrastination and indifference are the friends of Fiji disease—never leave until to-morrow any inspection or digging out of diseased stools which can be done to-day.

—A.F.B.

Drainage for Wireworms.

THE following notes are issued in respect of the low-land wireworm pest, particularly in the Mackay area. Other species of wireworms may be found in well drained and elevated lands but the damage to cane caused by them is of little consequence, although they are often blamed for bad strikes due to other causes.

As was forecast in the Quarterly Bulletin for July, 1936, damage to cane plantings by wireworms in the Mackay district was both widespread and severe during the spring of 1936. In very many cases the warning issued against early planting went unheeded, with the result that many blocks had to be heavily supplied or replanted. At the

Plate 289.

A poor stand of cane in a badly drained depression due to the eyes of setts having been destroyed by wireworms.

Mackay Experiment Station Field Day and again in the Quarterly Bulletin for July of this year it was pointed out that the wet season had been such as to favour the development of wireworms and a warning was again issued against early plantings where drainage was inadequate.

In addition, on each occasion, the necessity for drainage *prior to the wet season* was emphasised. As we have repeatedly pointed out, in its young stages the young wireworm requires extremely wet soil conditions in order to survive, although it can later withstand very dry conditions. It is to avoid providing this extremely wet condition during the rainy season that adequate drainage is necessary.

Severe losses have been caused by wireworms during the current spring and are still being experienced. As is usual at such times many theories and "cures" are advanced, but exhaustive experimenting and practical experience in the Mackay district has proved that the only method of controlling the lowland wireworm pest of cane is to have the land thoroughly drained in readiness for the wet season prior to planting.

Consequently, all farmers who have fields which are to be planted in 1938, and which are liable to wireworm attack, should immediately set to work and provide the necessary drainage. It is realised, of course, that some fields, or parts of fields, cannot be drained satisfactorily and in such cases, following a heavy wet season, planting should be delayed until late September at the earliest.

Advice as to drainage systems or information regarding farms where the wireworm damage has been eliminated by proper drainage, will be given on application to the Entomologist, Sugar Experiment Station, Mackay. Good drainage is not only valuable from the point of view of wireworm control—it is good sound agricultural practice whether wireworms are present or not.

W.A.McD., in the "Cane Growers' Quarterly Bulletin."

SUGAR-CANE VARIETIES FOR SOUTHERN QUEENSLAND.

Those growers who have not yet experienced the benefits from growing the new gum-resistant canes, which recently have become so popular in Southern Queensland, are urged to include some in their present planting. The results from all trials harvested to date indicate that Co. 290 will produce a much heavier yield than any other variety on practically all types of soil. It generally gives a fair c.c.s. value, while at times very good returns are reported. On damp alluvial lands it tends to maintain continuous growth, and with an "open" winter, heavy cane tonnages with low c.s.s. might result. Such conditions constitute but a small proportion of the lands on which the variety could be planted.

For all-round performance, P.O.J. 2878 is to be recommended strongly. For vigour of growth and drought resistance, it definitely excels, and as a standard cane it has no equal. This is a most important feature, as it enables the Southern grower, on frost-free areas, to revert to the "two-year cropping" methods, which were so popular before gumming disease took its toll, and which enable the grower to effect such a substantial lowering of the costs of production. In these times, when excessively large crops demand that a proportion of the cane be stood over, no cane responds so satisfactorily in its second year of growth as a ratoon crop of this variety.

P.O.J. 2725 is a cane which has shown remarkable yields where mositure conditions are suitable, and it definitely is a valuable cane for irrigated land. Near the coast, it exhibits an unfortunate tendency to arrow early, which is a detriment if the farmer is obliged to stand-over the crop.

—A.F.B.

FERTILIZING SUGAR CANE.

As the outcome of experiments by the Bureau of Sugar Experiment Stations it has been established definitely that it pays to fertilize sugar-cane crops on all old lands. It is found, also, that there is no one "best kind" of fertilizer for all types of cane soil, but that special mixtures are necessary for particular conditions. The Bureau has devised three special mixtures which are now prepared by all leading manufacturers, and farmers are urged to use these "Sugar Bureau" fertilizers at all times. No. 1 mixture is rich in phosphate, low in potash, and is generally suitable for alluvial and forest lands. No. 2 mixture is suitable for red schist soils and lands requiring a balanced mixture, while No. 3, rich in potash, should be employed exclusively on red volcanic soils.

It should be noted that these mixtures contain very little of the plantfood nitrogen. Their use, therefore, should be combined with top-dressings of sulphate of ammonia.

The following recommendations may be followed as a general procedure:—

Plant Cane.—Apply the appropriate Sugar Bureau planting mixture in the drill with the cane plants, and top-dress with sulphate of ammonia when the crop is stooling.

Ratoon Cane.—Fertilize with the appropriate Sugar Bureau ratooning mixture, in a furrow close to the cane stools. Top-dress with sulphate of ammonia when the ratoon shoots are 12-18 inches high.

Plant cane following a green manure crop will require no top-dressing with sulphate of ammonia, but ratoons always respond to this treatment. Early manuring ensures a vigorous crop, and pays better than late fertilizing.

Sugar Cane in New Guinea.

A. F. BELL.*

WE have recently been favoured with a visit from Mr. W. M. Pestell, of the Department of Agriculture, in the Mandated Territory of New Guinea, and it is thought that some of his remarks may be of more than passing interest to Queensland canegrowers. The opinion is held by botanists that sugar cane probably originated in two parts of the world, namely in India and New Guinea. The Indian canes are of the thin, hard type and are low in sugar content; New Guinea canes are of varied type, but heretofore interest has centred on the so-called "noble" type of which Badila, the Gorus and Mahona, are well-known representatives. Indeed the early collectors of cane varieties in New Guinea collected only the noble types of cane or, in other words, collected only those varieties which gave promise of immediate commercial value. In more recent years, with the expansion of cane breeding activities, attention has been also directed towards the "wild" low sugar types with a view to incorporating some of their vigour and hardiness in seedling canes.

Mr. Pestell is strongly of the opinion that much of the Mandated Territory of New Guinea is still unexplored from the cane variety standpoint and especially does he consider this to be so in the case of the so-called "uncontrolled" areas. This "uncontrolled" territory lies inland on the island of New Guinea and extends from the borders of Dutch New Guinea and Papua down to a line which runs roughly parallel to, and about 50 miles from, the coast. It therefore consists mainly of elevated land, rising from a height of about 600 feet above sea level to culminate in the 13,000 feet of Mount Hagon. Owing to this great range in elevation there is inevitably a great variation in climatic conditions. Sugar cane of various types is widely distributed, growing both naturally and under cultivation, and in places has been observed by Mr. Pestell growing at the astounding elevation of 10,000 feet.

Due, doubtless in part, to the cooler climate, the natives of the elevated lands appear to relish the energy-producing sugar, and they are more agriculturally inclined than the coastal natives; consequently, sugar cane is much more widely cultivated by them than by the natives on the coastal belt. For this reason, and the fact that hitherto "closed" territory is being made accessible, together with the development of aerial transport facilities, it is considered that these elevated lands offer a very promising field for cane collectors. Cane is found growing extensively on other islands, notably New Britain, and also on the coastal region of the island of New Guinea.

The cane is cultivated along with other crops in communal gardens by the natives, each village having one to several gardens situated in its vicinity. A village of 100 people may have some 15-20 acres under general cultivation, cane being a major crop at the higher elevations. The land is cultivated only for a period of 1-2 years and then a new site is selected. No irrigation is practised but the rainfall is well distributed, there being no distinct dry season. Varieties are collected during friendly

* In the "Cane Growers' Quarterly Bulletin" (Bureau of Sugar Experiment Stations, Dept. of Agriculture and Stock) for October.

visits or by raiding parties to neighbouring villages. As a rule the cane is planted in the form of setts but occasionally rooted plants are removed. Plants are not placed in furrows but have the earth heaped up in mounds above them; planting is generally done in an irregular fashion, but in some localities in the interior the stools are set out in rows and the fields squared up. Varieties may be mixed but on the other hand a village may grow only a single variety. Planting is carried out at any time of the year and is usually associated with ceremonial observances designed to propitiate the spirits and ensure the success of the crop.

The natives select the varieties to be grown mainly on their suitability for chewing and consequently there is a tendency to select low fibred canes which frequently have to be supported by bamboo frames. In this connection it is interesting to note that Badila is regarded as a comparatively high fibred cane! Dried strips of cane rind are used to line the native houses; the cane is split open, pressed under stones, the dried flesh pulled off, and the strips of rind then woven to form a coarse mat. The dried tops are used for bedding. In addition to chewing-cane, the " wild " type of cane is grown as a green vegetable, the young tops being cooked and eaten.

At least three types of cane have been observed; the well-known noble (Badila type) cane, the " wild " cane (thin, hardy and low in sugar) and the " robustum " type, a tall vigorous type which was first observed by the Brandes expedition in 1928. The robustum type is cultivated to some extent but also grows prolifically in the natural state, especially along the rivers. There also appear to be many hybrids and it is of great interest to note that two plants, identified at Kew as being cane-sorghum hybrids, were found growing naturally near Kaiapit, on the Upper Markham River, at an elevation of some 1,300 feet. Naturally growing canes may occupy considerable areas in some places and tracts of some 20-30 acres of an almost pure stand of sugar cane may be observed at times.

Arrowing is generally prolific, and is not confined to a restricted period as in Australia, but varies according to locality and elevation. Arrowing is apparently regarded by the natives as a symbol of maturity, as they frequently will not harvest the cane until it has arrowed.

No comprehensive pathological survey of sugar cane in New Guinea has ever been carried out, but Fiji disease and mosaic have been observed in many localities, the latter being most common in the very wet southern coastal districts of New Britain. Doubtless further surveys would reveal the presence of many more diseases of cane.

It is of more than passing interest to the cane breeder to reflect that these two diseases, and especially Fiji disease, have coexisted with sugar cane in New Guinea down through the ages without gaining the upper hand. It is obvious that in those regions of New Guinea where Fiji disease occurs, the indigenous canes must have very considerable resistance to the disease—otherwise they would have been wiped out ages ago. Now Fiji disease is of great potential importance in Queensland, and especially in Southern Queensland. It is very desirable and, indeed, necessary that the vigour of the noble canes be improved by crossing back to the wild hardy types, and we can see some of the results and possibilities of this procedure in the new P.O.J. canes, which are descended from a wild cane of the Dutch East Indies. Unfortunately, the introduction of

this particular strain of wild blood also confers great susceptibility to Fiji disease (and other diseases). It would appear logical, then, that other strains of wild canes should be sought for breeding purposes in regions where long association with Fiji disease has ensured their resistance to it. What applies to Fiji disease may also well apply to other diseases, such as downy mildew. It would therefore appear that the Queensland Sugar Industry, which already owes much to New Guinea, may well profit further by availing itself of the wealth of cane-breeding material still available in that neighbouring but yet largely unexplored island.

EFFECT OF WINDS ON CANE GROWTH.

The red soil area of the Bundaberg district is characterised by strong winds which blow freely throughout the year. The effect of strong winds on cane growth has been recorded in other cane countries, and the results are marked at the Bundaberg Experiment Station, particularly on the south-eastern corner which is devoted to cane seedlings.

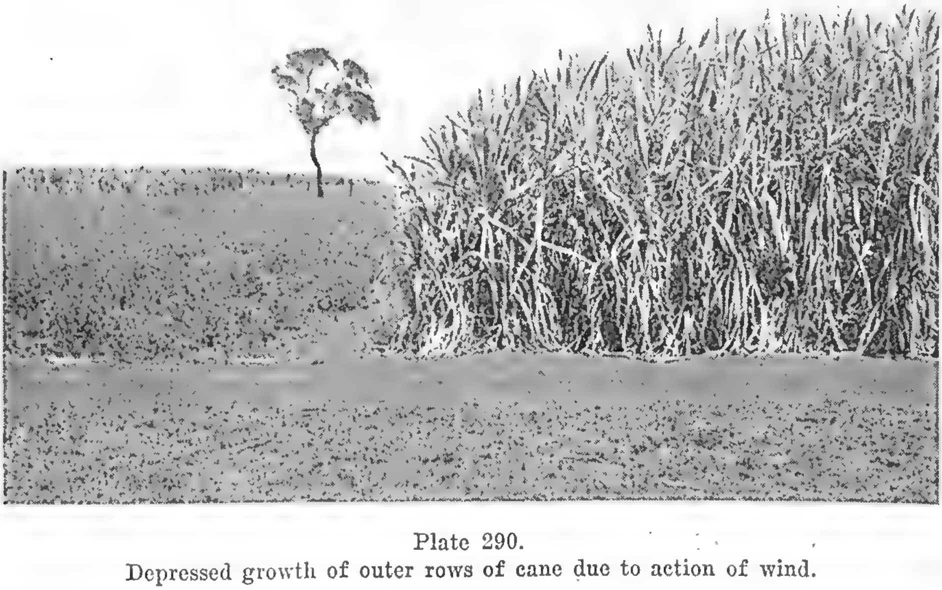


Plate 290.
Depressed growth of outer rows of cane due to action of wind.

To overcome this trouble, a giant privet windbreak has been planted along the southern border of the Station, and is making excellent growth. It is hoped that the protection it will afford in a year or two will minimise the effects of south-easterly winds, which are the most serious.

The accompanying photograph shows very strikingly the effect of wind-blowing on the outer rows of cane of one of the Station blocks.

In passing, attention is directed to the crop of lupins on the left hand side of the illustration.

N.J.K., in the "Cane Growers' Quarterly Bulletin"
(Bureau of Sugar Experiment Stations).

Sooty Mould on Sugar Cane in the Babinda District.

DURING the past two years we have received a considerable number of reports from farmers in the Babinda area that their cane is being badly damaged by sooty mould. The symptoms of this so-called disease are probably familiar to most farmers; during dry weather the leaves, especially lower leaves, become covered with a black sooty deposit, causing the plants to present a dirty sick appearance; it will also be observed that this sooty deposit is worst in patches where the cane is stunted. Actually the cane is not diseased, in the strict sense of the word, although it is not claimed that no stunting results from the "suffocation" of the cane leaves by this sooty deposit.

On turning back the leaves of cane, especially stunted cane, growers may frequently observe colonies of a dirty yellowish aphid on the lower surface of the older leaves. This aphid is known as the cane aphid (*Aphis sacchari*) and as it feeds it secretes a sweet honey dew. The spores or "seeds" of a particular fungus fall on the leaves and germinate and grow in this rich, sweet honey dew without actually penetrating the cane leaf at all. The sooty coating may be rubbed off the leaf with the finger; it is exactly similar to the sooty mould which is so common on the leaves of citrus trees in North Queensland.

The cane aphid thrives during dry weather, and consequently with the advent of a long dry spell, the sooty mould also makes its appearance. On the other hand wet conditions very rapidly kill off the aphid population and the sooty mould disappears again.

Normally, cane aphids are found in appreciable numbers only on the lower older leaves of the cane, and hence the sooty mould which follows them can do little or no harm. However, during prolonged dry spells, and where the cane is already sickly and stunted, the aphid will be found feeding on quite young leaves, and so we soon get the appearance of the sooty mould on such leaves also. Although the sooty mould fungus does not attack the plant directly it seems obvious that it must cover up the leaf pores and cause still further stunting. That is to say the sooty mould does not start the cane on the downward path, but does "kick it when it is down."

It will be seen then that to avoid the effects of sooty mould it is necessary to rectify the cause of the stunting in the first place. During the past season several inspections have been made by members of the Division of Entomology and Pathology—and they have found that sooty mould is definitely worst on the low lands, and particularly so in local badly drained depressions. Although present the disease was very much less marked on the elevated red soils. The chief factors causing the initial stunting on the low-lying areas appear to be 1, inadequate drainage; 2, low fertility or high acidity; 3, chlorotic streak disease. The provision of adequate drainage needs no elaboration and the field officers of the Bureau are at the service of farmers for the purpose of taking soil samples for the determining of the correct fertilizer to be used or amounts of lime per acre required. Chlorotic streak is a disease which has been observed in Java, Hawaii, Puerto Rico and Australia, but its

cause still remains obscure. Experiments have shown us that it spreads fairly rapidly in the low-lying areas of the heavy rainfall districts of Queensland, but that it spreads very slowly, if at all, in elevated fields. If diseased cane is planted in a field on a red volcanic hillside, for example, the resultant plants will be diseased, but the disease does not spread into the adjacent healthy cane. Consequently, it follows that in the Babinda area it is bad practice to take cane plants from the river flats up to the hills but, on the contrary, it would help the control of this disease very considerably if the flats could be planted with selected cane from the hills. We say selected cane advisedly, since there is chlorotic streak disease in hillside fields which have been planted with diseased cane. The symptoms of chlorotic streak disease are only visibile in young cane and consequently cane which is to be used for plants in the autumn or spring of 1938 should be selected round about November-December of this year. Such inspections and the keeping of records as to the suitability of individual blocks for plants would require the services of a resident field officer which, unfortunately, the district does not possess. Healthy cane when planted on the flats will definitely contract this disease but the planting of healthy plants enables it to get off to a good start, and experiments carried out by the Bureau have indicated that a nett gain of some 25 per cent. may be expected in both plant and ratoon crops.

Two chlorotic streak-sooty mould resistance trials with over twenty varieties have been planted in the Babinda area this year, and their progress will be watched with interest

A.F.B., in the "Cane Growers' Quarterly Bulletin."

Some Tropical Fruits.

No. 17. THE ROSE APPLE.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

THE Rose Apple is a member of the large family Myrtaceæ, and is a native of India and Malaya. The tree is of medium size and in this country is of bushy habit, making an ornamental specimen. The leaves are about 5 to 8 inches long by 1 to 2 inches wide and are thick and glossy. The young foliage is wine coloured; consequently a tree in young growth is very handsome.

The flowers are produced in terminal racemes on the smaller and younger branchlets. They are white with numerous long stamens which form the most conspicuous part of the flower, almost hiding all the other parts. The fruit grows up to 2 inches in diameter, and is usually round or sometimes slightly elongated. It retains the calyx segments conspicuously on the apex. When ripe it is of a creamy colour, and the flesh a light creamy pink. The ripe fruit is very similar to the common guava both in outside appearance and in texture of the flesh. The flesh is $\frac{1}{4}$ to $\frac{1}{2}$ inch in thickness, and the large central seed cavity of the fruit contains one round seed about $\frac{1}{2}$ inch in diameter, lying loose in the cavity.

The flesh is similar to that of the guava but is not so highly flavoured, and is much less palatable. The fruit has, however, the distinction of being very sweetly scented, comparable to a highly scented rose. It is this distinction that gives rise to the common name of the fruit. It also makes it popular in some countries as a table decoration. Although rather poor as a dessert fruit it is said to be delicious in the preserved or crystallised form.

The tree is now largely distributed throughout tropical countries. It was probably introduced to Queensland about forty years ago and is now growing well in the tropical part of this State, although at the present time only in limited numbers. The ideal conditions for its

growth are a moist and warm climate, with a good, deep, loamy soil, but it seems to be fairly hardy and will thrive under much less congenial conditions. In fact, Popenoe reports that in America it grows on sandy soils and in subtropical climates. However it is, strictly speaking, a tropical fruit.

In Queensland the tree blomms from July to October, and the fruit is in season between September and Christmas. The tree is not a heavy cropper however.

Plate 291.
Flowers and Ripe Fruit of the Rose Apple.

Propagation of the Rose Apple is usually by seed, but P. J. Wester has found that in the Philippines it may be propagated by budding. If a particularly good specimen should be located propagation by this method would be advisable, but the general type met with does not warrant it.

Botanically the tree is known as *Eugenia* jambos (L.), sometimes *Caryophyllus jambos* (Stokes) or *Jambosa vulgaris* (D.C.). The common name of Rose Apple is adopted in most English-speaking countries; Jambu is used in India and Malay; Yambo, Yambosa, Tanpul, &c., are various names applied in different parts of the Philippines.

Sawdust Packing for Grapes.

JAS. H. GREGORY, Instructor in Fruit Packing.

IN the past, when exporting Australian grapes overseas it has been necessary to use granulated cork as a filler. For many years Australia has been importing grapes packed in sawdust from California during the off season. For a long time, a search for a suitable sawdust has continued in Australia. The main difficulty has been in overcoming wood taint which was absorbed by grapes stored for lengthy periods necessary during storage and transport. Various kinds of sawdust have been used without success, but at last a treated type of sawdust has been obtained which, when packed with grapes and stored for eighteen weeks, left them taint-free. The wood used was Queensland hoop pine.

Another difficulty has been to obtain the size and shape of granule in the sawdust, but with the co-operation of officers of the Queensland Forest Service this has been overcome. Only certain types of saws will throw off a suitable sawdust comparable with the sawdust used for fruit packing in America. For the present, however, only a limited quantity of this sawdust is available. The price, in consequence, is so high that a comparison of the value and the quantity required for a case with that of cork is not favourable enough, for the time being, to warrant the general adoption of sawdust. The cause of this is the very low recovery of sawdust of the required coarseness from the special saw in use. This sawdust is actually finer than that used in America.

Past experience of the use of cork leaves one with the opinion that it might be possible to use a finer type of dust-free sawdust for packing. This would mean a far greater recovery, and therefore a substantial decrease in price. To ascertain definitely if this is possible, further experiments are to be conducted during the coming season. In the meantime, growers are advised not to rush into using any type of sawdust which may be obtainable in their districts without first subjecting it to exhaustive tests as to its suitability for packing and freedom from taint. The sawdust used experimentally was carefully sieved to remove the finest particles, and then carefully dried until only a 12 per cent. moisture content remained. American sawdust is obtained from timbers such as redwood, spruce and Douglas fir. Investigation will probably show that many Queensland timbers can be used for sawdust for fruit packing if treated correctly. Unless definite taint-free dusts are obtainable, great damage might be done to the grape export trade by the use of unsuitable sawdust. It only needs one or two consignments to show signs of taint, and arguments similar to those that arose in respect of butter boxes will immediately be used.

A short account of the experimental test follows:—

Two cases of Servante grapes were packed on the 22nd March, one with cork and the other with sawdust. These were placed in Messrs. Birt & Co's. cold store under the usual trade conditions. The object was to ascertain the extent of the presence of taint, if any, in the sawdust, and also make a comparison between the merits of the sawdust and cork from the following viewpoints:—

(*a*) Taint;

(*b*) Breakdown of fruit;

(c) Adherence of packing material to fruit.

The following observations were made:—

(a) *Taint.*—With the cork-packed fruit a slight musty corky flavour was noticeable, due no doubt to a minute covering of the fruit with very fine dust. With sawdust no taint was noticeable in the sound fruit, but a few damaged berries had a faint wood taint, caused possibly by the damping of the wood with the fruit juice.

(b) *Breakdown of Fruit.*—The fruit in cork definitely showed greater breakdown. A few cases of "nests" of rotting berries were observed. There was a much greater incidence of mould development noticeable on those in the cork filler. The sawdust pack did not show any tendency towards developing "nests" of unsound fruit.

(c) *Adherence to Fruit.*—Sawdust definitely does not adhere to the fruit in the same way as the cork. Apparently, it can be cleaned of fine dust better than cork. This causes the bunches to open up much fresher in appearance. Sawdust-packed fruit also maintained better its natural bloom on the skin, looking quite fresh in comparison with the fruit packed in cork.

The weight of sawdust used to the case was approximately 9 lb., as compared with 4 to 5 lb. of cork. These weights would, of course, vary with the type of bunch used for packing, so can only be taken as an example. With the present price of cork at 4½d. per lb., the total cost of packing a case would average about 1s. 6d.

The fruit used was handled in two different ways. One section was picked on Friday morning, 19th March, the other section about 5 p.m. on Saturday, 20th March, a difference of approximately 30 hours before packing. When taken from the case, six weeks later, no appreciable difference could be observed in the appearance of the fruit of either lot. Stalks were slightly shrivelled in both lots. The Servante variety, on account of its tendency to tight bunches, is not altogether a satisfactory type for storage and long transit—the tightness of the fruit making it difficult to trim out the slightly damaged berries which are the causes of "nests" of rotted fruit. These "nests" in the case of this experimental fruit, consisted of up to five berries each.

To ascertain the extent of time available for retailers to handle these grapes when removed from storage, bunches were removed from the sawdust and cork and stored under ordinary room climatic conditions. At the end of four days the bunches were still good in appearance, but at least 20 per cent. of the berries were dropping from their stalks. Bunches left untouched in the packing material were in better condition when removed than those removed the first day, showing an approximate 10 per cent. fall of berries. From the commercial point of view, this is fairly satisfactory.

In analysing these results, it must be remembered that before the harvesting of this fruit very heavy rains were experienced, to the detriment of the keeping qualities of the grapes.

In addition to this, a case of Purple Cornichon grapes was packed on the 5th April, containing two sections, one packed in cork and the other in sawdust. This fruit was displayed in the fruit section in the court of the Department of Agriculture and Stock during the last Brisbane Exhibition, having been 10 days out of cold storage before the fruit was unpacked. The following observations were made:—

By the end of the exhibition, the grapes had started to show signs of shrivelling with both types of filler.

The fruit in sawdust was definitely in better condition than that in cork.

The fruit packed in cork had a tendency to show "nests" of decayed fruit; the sawdust pack was comparatively free from this fault.

No signs of taint could be noticed in the fruit packed in the Queensland sawdust, but the cork-packed fruit had a very slight musty flavour.

Berries in both packs had reached their limit of storage, and showed a marked tendency for dropping from the stems.

ACKNOWLEDGMENT.

An acknowledgment is due to officers of the Queensland Forest Service for their co-operation in obtaining and treating suitable timber; to Messrs. Birt & Co. for cold storage facilities and attention; and to Mr. R. L. Perkins, of Ballandean, for making the fruit available.

THE CONTROL OF THE RED-SHOULDERED LEAF BEETLE.

N. E. H. CALDWELL, B.Sc., Agr., Assistant Research Officer.

The red-shouldered leaf beetle has again made its appearance this spring, notably on citrus orchards in the Maroochy district, where it has been damaging flowers and foliage to a serious extent. In recent trials, dusts containing either or both pyrethrum and derris as toxic ingredients were used on citrus trees carrying a fairly heavy infestation of beetles. The results with pyrethrum were particularly satisfactory. There was an almost complete drop of semi-paralysed beetles within a few minutes, and observations suggested that only a very small proportion of these recovered sufficiently to fly or to climb the trunks of the trees.

Growers are, therefore, recommended to combat this pest by the use of a pyrethrum dust. If pure pyrethrum is purchased, it can be mixed with equal parts by weight of kaolin (a cheap filler) to reduce the cost of the treatment. As derris is somewhat slower in action and considerably less effective against this pest than pyrethrum, dusts containing the former insecticide alone cannot as yet be recommended for the control of the red-shouldered leaf beetle.

Dusting should be done in the early morning when the beetles are relatively sluggish and less apt to fly away when dusted. The lower temperatures prevailing at an early hour do not appear to impair the efficiency of the dust.

Dusting should be thorough and, in the case of a large tree, should be done both inside and outside the tree. Each insect must come in contact with the dust, either directly as it comes from the duster or indirectly as the beetle moves over foliage carrying a layer of dust. It is not necessary, however, to use excessive quantities of the dust. A fine cloud of dust passing through the tree is all that is required.

A number of beetles will be observed, in the early mornings at least, on any weeds under the trees. These should also be treated. In any case, some little time after the tree has been dusted, the beetles which have fallen to the ground should be given a light dusting to make sure that every one receives a lethal dose of the poison.

This method of dealing with a pest that has for years been a periodic worry to growers of many crops is easy to apply, effective and reasonably cheap.

Strawberry Culture.

W. G. HANCOCK, Fruit Branch.

At the present time, two strawberry cultural matters are due for consideration: (1) The treatment of old beds for next year's crop; and (2) Runner production for next year's planting.

The peculiarities of the strawberry in forming new main roots from higher parts of the stem is often overlooked, but nevertheless it is a very important characteristic which should be taken into account. The cultivated strawberry has inherited this habit from its woodland ancestors, which every year after cropping in the summer were half buried by the autumnal fall of leaves from the trees above them. Thus, after the strain imposed upon the plants by the crop, they are annually re-invigorated by the leaf mulch.

In applying this to Queensland, it requires to be kept in view that, under European conditions, the strawberry fruits in the summer and rests during the winter; while here it fruits during the winter, and subsequently undergoes, to it, very trying conditions during summer. In addition, therefore, to providing a medium to support the freshly-forming roots, a thick mulch will keep the top of the soil cooler and moister during the summer, and thus help to offset the rigours of a sub-tropical summer on a temperate plant: The result will be stronger plants for next year's crop, and better and stronger runners for next year's planting.

On the question of runner production for next year's planting, in most countries what is referred to as runner deterioration has been noted, and an improvement in the quality of plants with a view to arresting this tendency has been sought.

It has been definitely confirmed that a restriction in the number of runners per plant results in the production of better runners for planting out, and better fruit production. Five should be the general rule. An authority goes so far as to recommend that (1) a special bed be planted for runner production; (2) after the plants have become established, all weak diseased or abnormal plants be pulled out; (3) pick off the blossoms as they form; (4) allow five runners to each plant and stop after the first runner plant.

Strawberry growers would do well to give these recommendations a trial next year. Meanwhile, measures should be adopted to keep the plants strong and healthy with the object, firstly of having the old plants in better shape next year for cropping, and, secondly, to encourage the formation of strong runners for future planting. These consist of (1) clean-up and cultivate old beds; (2) fertilize; (3) draw up the soil to the plants and mulch with leaf mould or litter; (4) restrict the runners to five and stop after the first runner; (5) keep the beds free from weeds and irrigate when necessary, so that the plants shall not suffer from lack of moisture.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

THE recent heavy rains have been a welcome relief to all engaged in fruitgrowing. Localities near Brisbane have, however, had too much wet weather for some crops, especially tomatoes. From now until the end of the month, good quality tomatoes should maintain firm values. Stone fruits have also been affected adversely by the weather. Growers of stone fruits are advised to use the direct factory outlet for as much as possible, and so assist in avoiding an oversupply. Fruit sent to market and withdrawn later for factory use has the tendency to cause prices to ease. Direct consignments assist in obviating the chance of difficulties of this sort arising.

Prices at the end of November:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish—sixes, 4s. 6d. to 9s. a tropical case; sevens, 5s to 12s.; eights and nines, 6s. 6d. to 12s. 6d. Bunches—Cavendish, 1½d. to 5d. per dozen; Lady Fingers, 4d. to 9d. per dozen.

Sydney.—Sixes, 10s. to 16s.; sevens, 16s. to 19s.; eights and nines, 19s. to 22s.

Melbourne.—Sixes, 12s. to 15s.; sevens, 15s. to 17s.; eights and nines, 17s. 6d. to 19s.

Pineapples.

Brisbane.—Smoothleaf, 7s. to 10s. per case; loose, 2s. to 8s. per dozen. Ripleys, 9s. to 11s. per case; loose, 1s. 6d. to 7s. per dozen. Some nice northern fruit has been seen on the local market.

Sydney.—8s. to 12s.

There are reports of leaky fruit on both Melbourne and Sydney markets.

Melbourne.—10s. to 16s.

Growers are warned to note that pineapples at the present time are ripe when showing very little colour. They should notify their agents to this effect.

Papaws.

Brisbane.—Yarwun, 8s. to 10s. a tropical case; Gunalda, 5s. to 6s. a bushel case; Locals, choice, 3s. to 5s. a bushel case.

Sydney.—10s. to 14s. per tropical case.

Melbourne.—10s. to 14s. per tropical case.

Mangoes.

Brisbane.—5s. to 8s. per case.

Sydney.—6s. to 8s. per case; selected types higher.

Melbourne.—Half-bushels, 5s. to 7s. Only selected types should be sent to the Southern States.

Passion Fruit.

Brisbane.—First grade, 7s. to 10s. per half-bushel; seconds, to 6s.

Sydney.—8s. to 18s. per half-bushel.

Melbourne.—12s. to 20s. per half-bushel.

CITRUS FRUITS.

Oranges.

Brisbane.—8s. to 10s. per case. Second crop fruit practically unsaleable.

Lemons.

Brisbane.—Gayndah, 10s. to 14s. per case; Byrnestown, 14s. to 15s. per case; Locals, 6s. to 9s. per case.

STONE FRUITS.

Peaches.

Brisbane.—Stanthorpe peaches are now in season. The quality appears to be an improvement on early consignments of past seasons.

China Flats, 1s. to 2s. per tray; specials higher.

Stanthorpe Mayflower, 4s. to 6s. per half-bushel.

Plums.

Brisbane.—Stanthorpe Wilsons, 2s. to 6s. per half-case; New South Wales Wilsons, 2s. to 5s. per half-case; choice grades higher.

Cherries.

Brisbane.—Stanthorpe, 7s. 6d. to 9s. per case; New South Wales, 6s. to 8s. per case.

Many lines opened wet, apparently through being packed and nailed down during adverse conditions.

Apricots.

Brisbane.—Warwick, 4s. to 8s. a half-bushel; Stanthorpe, small varieties, 4s. to 7s. per half-bushel; choice, 8s. to 10s. per half-bushel.

As Brown Rot is likely to develop rapidly under the present climatic conditions, growers should take all care to see that possible skin damage is reduced to a minimum. The use in the packing shed of a solution of 1 part of formalin to 20 parts of water as a cleanser is suggested. Picking and packing utensils should be sprayed with or dipped in this solution at least once a week.

Tomatoes.

Because of weather conditions the quality has fallen off. Only firm lines are wanted on the markets, soft fruit being almost impossible to sell.

Brisbane.—Ripe, 1s. to 3s. per half-bushel; green, 2s. to 3s. 6d.; coloured, 2s. 6d. to 4s. 6d.; few specials higher.

Sydney.—Queensland, 1s. to 3s. 6d. per half-bushel. Market over-supplied.

Canteloupes.

Brisbane.—5s. to 8s. per dozen, only light supplies available.

Sydney.—5s. to 8s. per bushel.

Melbourne.—8s. to 10s. per bushel case; some higher.

Apples.

Southern shippers are warned not to send apples to this market, except Yates and Crofton, or similar hard varieties. Many lines are now opening up soft and do not keep.

Brisbane.—Yates, 5s. to 10s. 6d. per case; Crofton, 7s. to 10s. 6d. per case; Democrat, 5s. to 9s. per case.

Pears.

Winter Coles, 10s. to 16s.; Winter Nelis, 9s. to 14s. per case; Josephine, 11s. to 14s. per case.

VEGETABLES.

Marrows.

No demand on any market; prices in Melbourne and Sydney unpayable.

Brisbane.—6d. to 2s. per dozen.

Sydney.—2s. to 4s. a tropical case.

Melbourne.—4s. to 5s. a tropical case.

Cucumbers.

Brisbane.—1s. to 2s. per bushel case.

Sydney.—1s. to 5s. Market over supplied.

Melbourne.—2s. to 5s. per bushel.

Peas.

Brisbane.—4s. to 6s. per bag.

Beans.

Brisbane.—6s. to 8s. a sugar-bag.

Lettuce.

Brisbane.—1s. to 1s. 6d. per dozen.

Cabbage.

Brisbane.—3s. to 5s. Inferior lower.

Chocos.

Brisbane.—9d. to 1s. 3d. per dozen.

PUBLICATIONS.

"Passion Fruit Marketing" is now available. "Tomato Marketing" is in the hands of the printer.

CHRISTMAS TELEGRAMS.

The Deputy Director, Posts and Telegraphs (Mr. A. B. Corbett), advises that arrangements have been made for Christmas and New Year greetings, sent by telegraph between the 20th December and 6th January, to be delivered on appropriately designed and coloured telegraph forms enclosed in pleasing and attractive envelopes.

These greeting messages should be written on the usual telegraph forms and lodged at any telegraph office, the word "Greeting" being added at the top of each form used. Telephone subscribers may send their greetings by means of the Phonogram Service. No additional charge is made for greeting telegrams—the usual telegraphic rates apply.

Greeting telegrams are also being accepted for transmission to places abroad at reasonably low rates, particulars of which may be obtained at any Post Office.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the advanced register of the herd books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Friesian Cattle Society, production charts for which were compiled during the month of October, 1937 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (STANDARD 350 LB.).			
Villa Maria Broady 5th	W. Henricksen, Ardilea, Clifton	9,273·0	459·688	Villa Maria Sir Charles
	JUNIOR, 3 YEARS (STANDARD 270 LB.).			
Morden Nessie	W. Henricksen, Clifton	7,047·75	271·246	Morden Stirling
	SENIOR, 2 YEARS (STANDARD 250 LB.).			
College Granny 5th	Queensland Agricultural High School and College, Lawes	6,156·3	259·468	Duplex of Greyleigh
	JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Alfa Vale Beauty II.	W. Henricksen, Clifton	7,361·25	280·428	Reward of Fairfield
College Flash 2nd	Queensland Agricultural High School and College, Lawes	6,022·95	231·948	Duplex of Greyleigh
	JERSEY.			
	JUNIOR, 4 YEARS (STANDARD 310 LB.).			
Glenview Blossom	W. S. Kirby, Byrnestown	4,677·9	292·092	Glenview Goldfinder
	SENIOR, 2 YEARS (STANDARD 250 LB.).			
Inasfayl Dark Flower	McGeehan Bros., Kairi	6,683·45	312·852	Oxford Royal Renown
	JUNIOR, 2 YEARS (STANDARD 230 LB.).			
College Linda	Queensland Agricultural High School and College, Lawes	4,297·94	234·761	Belgonia Peggy 9th's Duke
	FRIESIAN.			
	JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Ryfield Favourite 2nd	F. C. Noller, Kumbia	6,318·65	263·837	Ryfield Argus 2nd

The Tropics and Man

Mental Capacity.

DOUGLAS H. K. LEE, M.Sc., M.B., B.S., D.T.M., Professor of Physiology, University of Queensland.

Second Series: No. 5.

THIS aspect of tropical residence is one that naturally concerns an academic mind, but it is really of equally vital concern to every tropical dweller. None of us works with hands alone, and all our work goes for little unless part of a well-reasoned plan. The capacity of the individual to think for himself is as important as that of the organiser, particularly in the existing democratic state.

Handicaps upon the Nervous System.

It will be clear to you by now that the nervous system is placed at a certain disadvantage in hot climates by reason of a less reliable blood supply and by the threat of water deficiency within the body. There are probably other less obvious changes in hot climates which also affect the nervous system. The nerve cells are probably susceptible to changes in the blood a thousand times smaller than those we can measure by present means. To investigate these by modern methods is like fixing a watch with a crow-bar. The nerve-cells are susceptible especially to the secretions of the ductless glands, and there is a good deal of evidence that the balance of these glands is altered in hot climates.

Common Results.

Irritability is very common in tropical dwellers, particularly towards the end of a long spell of trying weather or hard work. In certain countries almost universal irritability, mounting frequently to uncontrollable anger, habitually follows a hot dry wind (mistral, foehn, sirocco). On the other hand, many mental disturbances have been attributed to climate when there is really some other cause. The "amok" of the Malaysian is probably due, for instance, to cerebral malaria.

Sleeplessness is also common, particularly in coastal areas when the night-time conditions are little better than the day-time. The necessary mosquito-net effectively cuts out what breeze is going and makes matters worse. This very real and common handicap can be partially overcome by using a net with a large upper surface made of netting, not calico, and by fixing a fan above the net. The fan should run at the lowest speed, and should be kept sufficiently distant to avoid draughts upon the sleeper.

Lack of concentration must be familiar to all who indulge in critical brain work. There is unwillingness to fix the mind and an inability to grasp details easily. The fatal spirit of manana ("to-morrow") steals in so unobtrusively that its presence is not realised until it is firmly established. It is only the strongest mind that can resist these changes, and then all too frequently at the expense of the bodily health.

Boredom is a very similar process, and is especially noticeable in equatorial islands where the climate hardly varies from one year's end to

the other. The greater part of tropical Australia is fortunate in having distinct seasons, at least in respect to man's personal life. The same alternation of seasons brings difficulties, however, to agriculture, particularly in the Northern Territory.

The reactions to these mental handicaps are sometimes excessive, and may then become anti-social. The terrific drinking and loose-living beloved of tropical writers (some of whom do not know the difference between mango and mangrove) is grossly exaggerated. Nevertheless, there is, I think, a greater tendency to turn to alcohol and other diversions in hot climates as an escape from boredom, insomnia, and isolation. Where the line is to be drawn between legitimate diversion and excess is a matter for individual opinion; but there can be no doubt, I think, that there is a drift away from the moderate towards, if not actually to, the excessive in tropical climates.

Mental Production.

Can mental work in the tropics reach the same quality as mental work in temperate countries? Can there be the same quantity of good mental production in the tropics? Is an attempt at maintaining temperate standards harmful to the body?

That mental activity of outstanding quality can be carried out in the hottest of climates and under the most unpromising conditions is quite clear, as the history of tropical medicine shows. This branch of medical science has been fostered by a host of brilliant men working under these very conditions; such famous names as Manson, Bruce, Rogers, Findlay, immediately spring to mind.

That the quantity and continuity of such work could be maintained, or that the good average brain-worker as distinct from the genius, could be as successful under tropical conditions is another matter. To compare the intellectual output of, say, Queensland and England, is not a fair test. Although the position is now rapidly improving, Queensland flowers all too often bloomed unseen by the rest of the world, or else were transported to England or America and quickly absorbed into and reckoned as part of the horticultural displays of those countries. I know of five very well-known English medical men who are, in reality, Australian products.

In view of the very frequent signs of interference with mental activity in the tropics, I doubt whether temperate standards of intellectual production can be maintained in quantity, at any rate by us ordinary mortals. Having worked successively in England, Signapore, and Brisbane, I have no illusions as to the relative productivity in my case, nor as to the relative effects of winter and summer months. Under emotional stress the mental activity may be artificially maintained for a while, but it usually turns out to be at the cost of general bodily efficiency and health.

Stabilisation.

Undoubtedly, one can make or neglect to make the best of circumstances. As I have suggested, even under the best of circumstances, I doubt whether one can realise one's full mental capacity in hot weather. It is very important, therefore, that all possible factors should be controlled to give the best working conditions. These improvements fall under four headings. If observed, they should minimise tropical interference with mental activities.

(1) *An Ordered Life.*—Nowhere is it more essential deliberately to arrange one's life for the best. A sufficiency of the best food (not necessarily the dearest, by an means), plenty of fluids, regular exercise, adapted to the body's requirements, periods of mental and physical relaxation definitely set aside and conscientiously observed, and good living conditions are essential. The degree to which one can abuse one's bodily and mental requirements with impunity is very much diminished in hot climates.

2. *Fixed Interest.*—Undirected amateurish mental pottering quickly degenerates into mental idleness. A definite interest must be created and a goal set up. The objective must be maintained even if, as will almost certainly be the case, a certain amount of flogging is needed to keep oneself up to it. The setting aside of definite times and the mapping out of a programme are very useful tricks for setting the pace. The only thing is, to set a reasonable pace, which will generally be a bit slower than the pace usual to temperate countries.

3. *Keeping up Contacts.*—Isolation is a great handicap to mental work in many tropical places, and often a danger. Deliberate attempts must be made to keep up contacts with other parts. This is now becoming easier by reason of air mails.

4. *Regular Holidays.*—A system of regular holidays is essential to the brain-worker. The advantages are two-fold—a relief from tropical stresses and an opportunity to re-establish contacts with fellow workers.

THE COMPOST HEAP.

One of the most economical methods of gaining good growth in the orchard is with the contents of the compost heap. Besides supplying a readily available plant food, the condition of the soil will be greatly improved by the added humus. It is surprising to note the variety of waste substances which can be put to profitable use in the compost heap. Farmyard manure, straw, weeds, dead leaves, and, in fact, almost all organic substances, both animal and vegetable, may be used. The size of the heap will be regulated by the quantity of material available from time to time, but provision should be made for a second heap so that the first heap may be topped off with a layer of soil and left to mature, from three to four months usually being sufficient for the process of conversion. In this way, a continuous supply of humus will be available.

If practicable, the heap should be built on a concrete base and framed with saplings. After each collection of refuse is added, dust the heap with lime and add a layer of earth. The heap should be kept in a moist condition. Overheating may be avoided by the use of more earth, which will absorb the ammonia given off in the process of fermentation.

When it is realised that the compost heap uses materials which would otherwise be wasted and converts them into a very valuable manure, it is a pity that its use is not more general.

The Apiary

As the season advances, the super combs will become capped over and are then ready to be taken off for the purpose of extracting the honey. The beekeeper will require to exercise some judgment as to when the honey is ripe enough to extract. Coastal districts, especially in heavily-timbered areas, are remarkable for the dampness of the atmosphere. In these districts it is a very safe plan to permit the cappings of the honey to extend over the entire comb face before removing it from the hive. Even then, the honey in these wet districts is of a rather thin character; in fact, it is almost impossible to attain the density of honey gathered from inland localities. On the other hand, in dry and hot localities the nectar ripens quickly, and the combs are ready to extract when the capping covers approximately half the comb face. Indeed, inland honey occasionally becomes so dense that considerable difficulty is experienced in extracting it. This sometimes occurs when a cold change, without rain, follows hot weather with a good honey flow. Unless it is unavoidable, honey should not be taken off when the weather is cold, as it will then be necessary to store the combs for a few days in a warm room in order to extract the honey.

There are machines on the market for ripening honey, but the majority of beekeepers leave the honey in the hives in preference to the artificial process. At times the honey flow is so heavy that the super is soon filled with unsealed honey. If the beekeeper now neglects to supply further storage room, the bees will almost invariably store honey in the brood-combs and crowd the queen for egg room. This is the chief cause of swarming at any season of the year. It also causes the bees to build a number of burr combs on the tops, sides, and bottoms of frames, making their removal a test of patience. Should the bees fill the super before any of the honey is ripe, it is advisable to furnish yet another super of foundation.

In order to improve the appearance of newly-extracted honey, it is a good plan to lay a piece of fine mesh cheese-cloth over the wire strainer of the tank. Although it causes the honey to be slow in passing through, it will catch a greater proportion of the scum. This is comprised of small particles of wax, pollen, and also air bubbles that have been forced through the honey during extraction. The honey should be permitted to stand in the tank to settle for a week when any remaining scum may be skimmed off the surface, after which the honey may be run into tins or bottles for market.

THE DAIRY FARM.

Large paddocks on a dairy farm are not economical. If practicable, the farm should be subdivided into a number of small paddocks, which allows for each to be grazed in turn, and then spelled for a period to enable the paddock to recover. Large paddocks often mean fodder wastage, as cattle roam all over the area, eating out the choice grasses and fouling the remainder, making them unfit for food.

A lot of waste results from faulty management of good pastures by stocking too heavily, which means, of course, that good grasses are eaten up quickly. If the paddock is spelled for a reasonable period, the pasture gets a chance to recover and the grasses have time to seed.

Unwise feeding methods constitute a prolific source of waste. It is necessary to balance the ration so that there will be no waste or loss in production through feeding an excess of one food constituent at the expense of another.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

A Common Weed. Hexham Scent.

J.J.S. (Helidon)—

1. *Fumaria parviflora,* the fumitory. A moderately common weed in Queensland. It is not known to possess any poisonous or harmful qualities.
2. *Melilotus indica,* melilot or Hexham scent. This plant was "boomed" as a fodder in Australia some years ago under the name of King Island melilot, but our experience in Queensland has been that stock do not take very readily to it, and have to become accustomed to its peculiar odour and flavour. It has the great disadvantage of tainting milk and cream rather badly. It is short-lived, being at its best during spring, dying off at the approach of hot weather towards the end of October or early November. As a fodder plant for Queensland for winter and spring months it is poor compared with some of the annual trefoils and clovers, such as the common burr trefoil and cluster clover.

It is a common weed of wheatfields, and if reaped with the wheat and stored for any period the peculiar penetrating odour is communicated to the flour and bread made subsequently.

Burr Grass. Chinese Burr. Chaff Burr.

T.G. (Cathu, North Coast Line)—

1. *Cenchrus australis,* burr grass. A native grass very common on scrub edges, hillsides, and similar places throughout the whole of coastal and near-coastal Queensland. It is very common in some pastures in North Queensland and on the Atherton Tableland is known by the rather absurd name of Scotch lice.
2. *Truimfetta bartramia,* Chinese burr.
3. *Achyranthes aspera,* chaff burr. So far as is known there is no easy method of getting rid of this plant. Frequent cutting, of course, will eventually exhaust them with the exception of the grass.

Numbers 2 and 3 probably would succumb to weak arsenical solutions or spraying with Weedex. Weedex would be preferable, as it is not known to be harmful or poisonous to stock in the weaker solutions used for weed poisoning. The Agricultural Chemist, Department of Agriculture and Stock, Brisbane, will give you the suitable strengths of the various poisons used.

Kangaroo Apple.

W.H.G. (Goondiwindi)—

Your specimen has been identified as the kangaroo apple, *Solanum aviculare,* a native plant and a weed of new burns, although it is not, of course, confined to such country. The berries are poisonous. The plant is generally left untouched by stock, but it is recorded that the young shoots, when nibbled by sheep, have caused death.

Dog Burr.

D.G. (Kangaroo Point)—

The specimen is *Bassia tricuspis,* a close relative of the galvanised burr and the black roly-poly of Central Queensland. The only local name we have heard applied to it is Dog Burr. It is very common in parts of Queensland, particularly in the Western Darling Downs and Maranoa districts, but we have received specimens from as far north as Clermont. It is a native plant and, apart from its burr nature, is not known to possess any poisonous or harmful properties.

South Burnett Plants Named.

F. (Leafdale, Wondai)—

1. *Silybum Marianum,* the variegated thistle, a very common thistle on the Darling Downs and in the Southern States. It has been thought at times —when eaten in large quantities—to have caused the death of stock, particularly sheep, but this has not been verified by feeding tests.
2. *Argemone maxicana,* Mexican poppy or prickly poppy. This weed is known under various local names, such as silver thistle and Californian thistle. It is, however, a member of the poppy family and not a true thistle. It is reputed to be poisonous, but is rarely touched by stock as. in addition to its spiny nature, it possesses an extremely bitter sap.
3. *Centaurea melitensis,* star thistle or Maltese thistle.
4. *Carthamus lanatus,* saffron thistle.

   Nos. 3 and 4 are two very common thistles in the Southern States, much more abundant there than in Queensland, but both, particularly No. 4, seem to be on the increase. All the abovenamed are annual plants and call for no special methods of eradication, other than those usually employed in cultivation.
5. *Physalis lanceolata,* ground cherry or wild gooseberry. This plant, a native of North America, has been observed in several places in Queensland, particularly on the Darling Downs. It is a much more serious pest than any of the others you have sent. The Council for Scientific and Industrial Research have it on their list of weeds for investigation. The only method of control, so far as we know, is to keep the green shoots regularly cut off as they appear above the ground so as to exhaust the old roots eventually.

If preferred, they could be periodically destroyed by spraying. This would have to be done several times as these plants have an underground stem system. Poison is not always effective on such plants—simply ''burning off'' the tops and leaving the parts unnder the surface to send out fresh shoots. Every effort should be made to keep it within bounds, and not let it spread by means of seed or pieces dropped here and there.

6. *Polygonum convolvus,* climbing buckwheat. Much the same remarks apply to this as to Nos. 1 to 4.

"Red Head" or Red Cotton Bush.

M.R.I. (Rockhampton)—

The specimen has been identified as the red head or red cotton bush, *Asclepias curassavica.* 8his plant is poisonous to stock and, among other symptoms are those of gastro-enteritis. However, in normal seasons, the plant is generally avoided by stock.

The Age of a Horse.

A.W. (Sarina)—

The following verses are printed in compliance with your request for a convenient form of memorising ways of telling the age of a horse:—

To tell the age of any horse,
Inspect the lower jaw, of course;
The six front teeth the tale will tell,
And every doubt and fear dispel.

Two middle nippers you behold
Before the colt is two weeks old;
Before eight weeks, two more will come,
Eight months the corners cut the gum.

The outside grooves will disappear
From middle two in just one year;
In two years from the second pair—
In three years ''corners'' too are bare.

At two the middle ''nippers'' drop;
At three the second pair can't stop;
When four years old the third pair goes,
At five a full new set he shows.

The deep black spots will pass from view
At six years from the middle too;
The second pair at seven years,
At eight the spot each corner clears.

From middle ''nippers'' upper jaw,
At nine the black spots will withdraw;
The second pair at ten are bright,
Eleven finds the corners light.

As time goes on the horsemen know
The oval teeth three-sided grow;
They longer get, project before,
Till twenty—when we know no more.

General Notes

Staff Changes and Appointments.

Mr. A. Nagle, Senior Instructor in Cotton Culture, has been transferred from Rockhampton to Biloela.

Mr. K. D. Hoffmann, Inspector, Diseases in Plants Acts, has been transferred from Dayboro to Nambour.

Messrs. S. C. O. Jessop and E. T. Lewin, Inspectors of Stock at Toowoomba and Dalby, respectively, have been appointed also inspectors under the Dairy Produce Acts.

Mr. H. Spottiswood, Clerk of Petty Sessions, Ayr, has been appointed also chairman of the Inkerman, Invicta, Kalamia, and Pioneer Local Sugar Cane Prices Boards, and also an agent of the Central Sugar Cane Prices Board for the purpose of making inquiries under Section 5 (2A) of the Regulation of Sugar Cane Prices Acts in regard to sales and leases of assigned lands.

Mr. O. St. J. Kent, B.Sc., A.A.C.I., Analyst, Agricultural Chemical Laboratory, has been appointed Senior Dairy Technologist, Dairy Research Laboratory.

Mr. W. G. McKechnie, A.A.C.A., Analyst, Agricultural Chemical Laboratory, has been appointed Assistant Senior Analyst, Agricultural Chemical Laboratory.

Mr. H. W. Ball, Assistant Experimentalist, has been appointed Experimentalist and Senior Clerk, Agriculture (General) Branch.

Mr. A. A. Salmon, Clerk, Chief Office, becomes Assistant Photographer, Publicity Branch.

Mr. S. C. Mossom, Court House, Innisfail, has been appointed chairman of the Goondi, Mourilyan, South Johnstone, and Tully Local Sugar Cane Prices Boards, and also an agent of the Central Cane Prices Board for the purpose of making inquiries under Section 5 (2A) in regard to sales and leases of assigned lands.

Constable C. H. Lowe (Mount Morgan) has been appointed also an inspector under the Brands and Slaughtering Acts, and Constable A. Bartkowski, of Westwood, has been appointed also an inspector under the Slaughtering Act.

The following appointments have been made in the Department of Agriculture and Stock:—

Division of Plant Industry (Research).

Mr. J. Harold Smith, M.Sc.Agr., Entomologist, has been appointed Senior Research Officer, Entomological Section

Mr. R. E. Soutter, Agricultural Research Officer, to the position of Senior Research Officer, Agricultural Section.

Mr. W. A. T. Summerville, M.Sc., Entomologist, Science Branch, to be Senior Research Officer, Horticultural Section.

Mr. H. K. Lewcock, M.Sc. (U.S.A.), B.Sc.Agr. (Adel.), Pathologist, to be Senior Research Officer, Plant Physiology Section

Mr. W. D. Francis, Assistant Botanist, to be Botanist, Botanical Section.

Wild Life Preservation.

An Order in Council has been issued under the Animals and Birds Acts extending the boundaries of the present sanctuary embracing Bald Hills Paddock and Nulla Waterhole on Salisbury Plains Station, in the Bowen district, and including the property adjoining belonging to Mr. A. Jensen.

An Order in Council has been issued under the Animals and Birds Acts, declaring an area embracing Macintyre Brook, Glenelg Station, Inglewood, to be a sanctuary for the protection of animals and birds.

The reserves for waterworks R. 426 and R. 151, Teddington, near Maryborough, have been declared a sanctuary under the Animals and Birds Acts, and it will be unlawful to take or kill any animal or bird within the boundaries of this sanctuary.

Grade Standards for Plums.

A regulation has been issued under the Fruit and Vegetables Acts prescribing new grade standards for plums. These standards provide that all plums must be graded according to size.

Rural Topics

When Buying a Pig.

It is not every day that we buy a pig, so it is worth while remembering a few points when considering the purchase of stores. Having decided the class and type of animals required, the next thing to do is to inspect the pigs on offer. Move them around and inspect each one individually, observing defects like rupture, rough, course skin and hair, and estimating what is the real and not the apparent, average weight.

A point that cannot be overstressed is that if a pig sale is attended for the purpose of purchasing stores and there is nothing really suitable on offer, or the prices are too high, it would be wise from a financial point of view to forget all about them.

Far too many people just buy because that was their original intention, forgetting the point as to whether the pigs put up for auction are worth a higher bid.

It is important to know the highest figure that should be bid, and the one which will turn out to be economically sound when the pigs are fattened up to pork or bacon weights. The class and age of the animals, of course, must be considered, but it is just as well to make sure that there is a reasonable margin of profit in prospect when the pigs go eventually to the butcher or the bacon curer. Only a simple calculation is needed, and the error, if any, should be on the low side, for optimism may turn out to be monetarily disastrous.

It is impossible to get away from the fact that some people are born salesmen or born buyers, but the qualities of both can be cultivated. It is a good thing to know just when to "get on" or "get out," but that knowledge must go hand in hand with sound practical farm management. A note of warning: Cheap pigs in low condition are no good to any man, and must eventually cause a heavy instead of a light expenditure.

Farmers' Breeding Flocks.

The want of the right type of ewe in the breeding flock is the Queensland fat lamb raisers' present difficulty. As a straightout breed the Corriedales should meet the requirements to the greatest extent. The sheep selected for the purpose should be of the true Corriedale type, possessing large, deep, well-formed frames and producing a long fleece of 56s 58s spinning quality. Should these not be available, then an English long wool crossed on the large-framed, plain bodied merino will be found satisfactory. The trouble with this type, however, is that if conditions are suitable for fattening lambs when they are on the ewe the temptation to sell them as lambs is too great. Well-grown crossbreds at five months can be sold usually to such advantage that it pays the man on good—and, therefore, expensive—country to sell them as lambs and buy ewes at the breeding age. Practically the only ewe at breeding age that is available in Queensland is the merino.

The only way out of the difficulty is for sheep farmers on suitable country further west to breed either pure-bred Corriedales or English long wool crosses, and sell the ewe progeny when about 2-tooth to the fat lamb raisers. The advantage of breeding to the pure-bred Corriedale is that only one breed is necessary; and, as they are suitable as a farmer's flock for both wool and mutton, they serve the dual purpose with the breeder, and the surplus ewes should meet with a good demand from fat lamb raisers. Much of the brigalow lands in the medium rainfall areas, when sufficiently developed and improved, can be used to advantage for sheep breeding, and the Corriedale is, it is considered, more suited to these areas than the merino.

—*J. Carew.*

Pigs Need Exercise.

Pigs kept continuously in sties or small runs spend most of their time sleeping or trying to get out of the enclosures. They are not given any chance of getting natural exercise, and when they go to the curer or pork butcher they fail to measure up to the full requirements of their class. Feeding and farm organisation may be perfect; large litter weights and early maturity may be the watchwords of management; and careful selection of breeding stock may be all that is desirable; but if the pigs have been denied opportunities for plenty of natural exercise they will be found to be unbalanced in fat and lean when they are cut up. Breeding, feeding, and open-air management are fundamentals in successful pig farming.

Rearing of Chickens.

The successful rearing of chickens is one of the most important points in poultry farming. Any setback which chickens receive, especially during the brooding stage, will be reflected in their development. Too much trouble cannot be taken to ensure that the chickens are reared under the most satisfactory conditions that circumstances will permit.

A reliable brooder is one of the first considerations—one that will generate sufficient warmth in the coldest weather to prevent the chickens packing together to get warm; and, at the same time, provide for plenty of fresh air. The brooder should be so constructed that the chickens can move away from the heat, if the temperature is too high, and get back again without any obstruction. Much of the wastage of chicken life could be avoided if due regard were paid to these fundamental factors in brooding.

The Best Type of Lamb for Export.

To meet the demands of both the home and the export trade, a true sucker lamb must be prime fat, irrespective of weight.

To produce the right lamb for export, at an age profitable to the grower, breeding is a prime essential. It follows naturally that different graziers have preferences for certain breeds of English sheep, but it may be laid down broadly that the best lamb for export is produced by a Downs sire—such as the Southdown or Dorset Horn—on ewes got by one of the long-woolled breeds—such as the Romney Marsh, Border Leicester, or Lincoln. The foundation merino ewe should be of a large-framed strong-woolled type. Corriedales make excellent breeders. Ewes in lamb should be maintained in good, strong condition, and no feed is too good for them.

From 30 to 33 lb. is the proper weight of a fat lamb, and this weight should be attained when it is about four months old.

"Don'ts" for Dairy Farmers.

Don't use cloths in the dairy—use brushes.

Don't leave skim milk about to go sour.

Don't leave utensils unscalded.

Don't fail to use boiling water to wash out the cloths used to wash the cows' teats and udders.

Don't put milk or cream in the cans which come back from the factory until they have been *scalded,* scrubbed with a brush, and aired.

Don't put a little night milk into the mornings can to fill it up.

Where milking machines are used, don't dip the tea cups in the water used to rinse the milk line—such water may spoil the milk and bring an inspector.

Don't fail to examine the milk pipe line and see that the tinning is perfect.

Don't fail to inspect the corners and crevices of the milking machine.

Don't fail to wash the hands with a clean cloth and water.

Don't fail to study the physical condition of the herd. This is more important than one would think. Especially is this very marked in drought time. The cow has the natural mother instinct very firmly rooted. With the natural resources of the body reduced to a minimum the cow commences much earlier to store up nutriment for the time when the calf arrives. Consequently, an animal which in an ordinary good season would give good milk up to six weeks before calving, would, under dry conditions, commence to reduce her milk yield three months before. A sick cow in the herd will spoil all the product.

Don't fail to examine the water supply used for both drinking and washing-up purposes. An epidemic of "ropey" milk and cream from one district was found to be caused by the wells getting low. They were cleaned out and the trouble disappeared. Low dams or creek holes are likely to give trouble.

Don't wash up with anything but boiling water, and don't rinse the utensils after washing with anything but boiled water, unless very sure that the source is good.

Don't feed on scorched young corn or water-logged saccaline.

Don't keep the cream truck waiting, and don't let the truck keep you waiting. Early delivery to the factory ensures quick treatment. Late deliveries have to wait in the lorries in the heat and so deteriorate.

The roadside pick-up should have a proper shelter, either built or thick foliaged trees. In the case of milk, one hour standing still is worse than two hours moving along.

Orchard Notes

JANUARY.

THE COASTAL DISTRICTS.

ALL orchards and plantations should be carrying a good cover crop which will help to check erosion during the wet season and maintain the soil in good physical condition when cut and turned under.

Pineapple plantations should be kept well worked.

Pineapple growers who have missed the spring planting will usually find it better to delay activities until the end of February. The idea is to wait until the main monsoonal rains have ceased. Then the ground will still be warm and moist; while there still remains a sufficiently long growing period to enable young plants to become established before the cold weather checks growth.

Bananas and pineapples may still be planted, though it is somewhat late for the former in the more southern parts of the State. Keep a good lookout for pests of all kinds, such as Maori on citrus trees, scale insects of all kinds, all leaf-eating insects, borers, and fungus pests generally, using the remedies recommended in Departmental publications.

Care is advised in the handling and marketing of all kinds of fruit.

Grapes are in full season, and in order that they may be sold to advantage they must be very carefully handled, graded, and packed, as their value depends on the condition in which they reach the market. Well-coloured fruit, with the bloom on and without a blemish, always sells well.

One of the greatest mistakes in marketing grapes is to send the fruit to market before it is properly ripe. A maturity standard for grapes is now in force, and immature grapes are liable to condemnation.

Bananas for the inter-State trade should be well filled but showing no sign of ripening. The fruit be carefully graded and packed and the cases marked in accordance with the regulations under the Fruit Cases Acts and despatched without delay.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

JANUARY is a busy month in the Granite Belt, and orchardists will be fully occupied gathering, packing, and marketing the crop of midseason fruits.

Much of the fruit may not carry far beyond the metropolitan market, but firm-fleshed plums, clingstone peaches, and good firm apples should stand the journey to the Central District; and, if they are carefuly selected and properly graded and packed, they should carry as far as Cairns.

Points to remember:—

The fruit must be fully developed, but yet quite firm when gathered.

It must be handled carefully. Bruised fruit is spoilt fruit.

Only one-sized fruit, of an even degree of ripeness and colour, should be packed in a case.

The fruit should be so packed that it will not shift, for if it is packed loosely it will be so bruised when it reaches its destination that it will be of little value. At the same time, it must not be packed so tightly as to crush the fruit.

Farm Notes

JANUARY.

FIELD.—The main business of the field during this month will be ploughing and preparing the land for the potato and other future crops, and keeping all growing crops clean. Great care must be exercised in the selection of seed potatoes to ensure their not being affected by the Irish blight. If possible, do not allow weeds to seed. This may be unavoidable in the event of long-continued heavy rains, but every effort should be made to prevent the weeds coming to maturity. A little maize may still be sown for a late crop. Sow sorghums *Setaria* Sp. (panicum), teosinte, and cowpeas. In some localities, potatoes may be sown, but there is considerable risk in sowing during this month, and it may be looked upon merely as an experiment. Plant potatoes whole. Early-sown cotton will be in bloom.

On coastal and intercoastal scrub districts, where recently burnt-off scrub lands are ready for the reception of seed of summer-growing grasses, sowing may commence as soon as the weather is suitable. Much disappointment may be saved, and subsequent expenditure obviated, by ensuring that only good germinable grass seed of varieties and quantities suitable to local conditions, is sown. The fact should be kept in mind that a good stand of grass is the principal factor in keeping down weeds and undergrowth.

In all districts where wheat, barley, oats, canary seed, and similar crops have recently been harvested, the practice of breaking up the surface soil on the cropped areas should invariably be adopted. Soil put into fit condition in this way will "trap' moisture and admit of the rains percolating into the subsoil, where the moisture necessary for the production of a succeeding crop can be held, provided attention is given to the maintenance of a surface mulch, and to the removal, by regular cultivation, of voluteer growths of all kinds. If not already seen to, all harvesting machinery should be put under cover, overhauled, and the woodwork painted where required.

Where maize and all summer-growing "hoed" crops are not too far advanced for the purpose, they should be kept in a well-cultivated condition with the horse hoe. Young maize and sorghum crops will derive much benefit by harrowing them, using light lever harrows with the tines set back at an angle to obviate dragging out of plants, but the work should not be done in the heat of the day.

Quick-maturing varieties of maize and sorghum may still be sown in the early part of the month in coastal areas where early frosts are not expected.

Succession sowings may be made of a number of quick-growing summer fodder crops—Sudan grass, Japanese and French millet, white panicum, and setaria. In favourable situations, both grain and saccharine sorghums may still be grown; also maize, for fodder purposes.

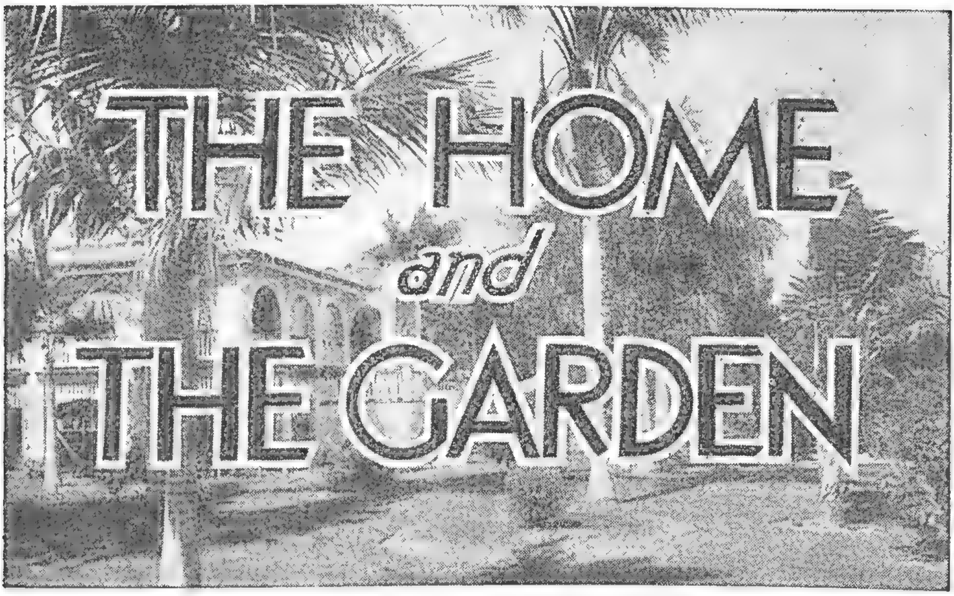
Fodder conservation should be the aim of everyone who derives a living from stock, particularly the dairyman; the present is an important period to plan cropping arrangements. Exclusive of the main crops for feeding-off (when fodder is suitable for this purpose), ample provision should be made for ensilage crops to be conserved in silo or stack. As natural and summer-growing introduced grasses may be expected to lose some of their succulence in autumn and more of it in winter and early spring, the cropping "layout" to provide a continuity of succulent green fodder throughout the season calls for thorough and deep cultivation and the building up of the fertility and moisture-holding capacity of the soil. Saccaline, white African or planter's friend (sorghum) may be sown at the latter end of the month for cutting and feeding to cattle in the autumn and early winter. Land should be prepared also for winter-growing fodder crops.

Plate [illegible].
Staghorn Falls, Yungaburra, Tableland, N.Q.

[*Photo. R. Lahey.*

Plate 293.

NEAR WHERE THE LYRE BIRD BUILDS HER NEST.—One of the numerous waterfalls in the Lamington National Park, Macpherson Range, South Queensland.



OUR BABIES.

Under this heading a series of short articles, by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

PUNISHMENT: THE HOW AND THE WHY.

THE following article is taken from the English journal, "Mother and Child," which is published by the National Council for Maternal and Child Welfare and its constituent societies:—

There is only one good reason for punishing a child—that is to make him understand that he must not repeat some action which you believe to be undesirable.

Some parents punish their child for other reasons—perhaps because what the child is doing annoys them and they want him to stop; perhaps just to "pay him back" because he has been naughty; perhaps because the parents are tired and so get angry easily. None of these reasons are good ones. They are unfair to the child. To punish him for any of these reasons will not improve his conduct or make him more inclined to be good. They will only teach him to keep out of his parents' way when tempers appear to be short.

Is He Really Naughty?

Before you punish be quite sure that what your child is doing is really naughty. Are you sure that he is not just playing some game or perhaps even trying to help you?

It is not naughty for a child to be noisy. It is not naughty for him to want to move about. It is not naughty for him to want to touch and hold things. Children need to move about and make a noise. And it is by handling and feeling things that they learn what the world round

about them is like. Of course, children do not need to be too noisy. They do not need to be rough. If they become too uproarious mother has to check them, but let her be very sure that their behaviour is unreasonable before she does so. Some children are naughty because they find it a sure way of getting mother's attention. If you have to punish your child again and again for doing the same thing, try different tactics. Praise him and give him lots of attention when he is good and pay no attention to him when he is naughty. Sometimes children are "whiny" and fretful simply because they are sleepy. The thing to do in such a case is not to slap them, but to see that they go to bed earlier, and that they have a nap in the afternoon.

Short tempers are often due to tiredness, even in the case of grown-ups, but mothers will agree that it is hardly fair to "take it out of" a child just because they are weary and irritable themselves. When people are tired they are irritated by little things that they would scarcely notice when their bodies and minds are rested. For example, one day baby may be playing with the saucepans in the kitchen earning everyone's approval for "helping mother." The next day he may do the same thing, to be rewarded with slaps for making such a noise, because mother happens to have a headache after a bout of washing. Now, is that fair to baby? Why was he slapped? Because he was naughty, or because mother was tired?

The wise mother will see to it that she has some rest each day. It will keep her from becoming overtired and help her to remain serene in dealing with her children.

Children Know What is Just.

Children are very keenly aware of justice and injustice. They know, for instance, that if they have been teasing their playmates it is fair for them to be made to play alone for a while. They know it is fair not to be given sweets when they have refused to eat their vegetables. They do not like these punishments, of course, but they do know they are fair.

Some punishments are much better than others. Smacking, scolding, locking a child in a room by himself, or forbidding him to play out of doors are not good ways of punishing, and the wise mother does not resort to them. She knows of much more effective ways of persuading her child to be good.

Perhaps her little boy has been bullying the children he plays with. She does not smack him or scold him, but she stops him from playing with them till he is ready to play nicely. If he forgets and renews his bad behaviour, then he must play alone again. Sooner or later he will learn that he must not hurt his playmates, because he wants to play with them; children do not like to be alone.

Another example—perhaps he does not come straight home from school or perhaps he does not come in when he is called. Mother does not say "To-morrow you cannot go out to play" because she knows he needs to be out in the fresh air and that it would be bad for him to go without play. Instead she deprives him of some small treat which it will not hurt him to go without.

Children who are naughty because they are tired do not need to be punished; they need to rest.

Some Golden Rules.

Pay no attention is a very useful rule for parents in a great many circumstances, particularly where temper, tantrums and fussiness about food are concerned.

The best plan of all, of course, is to keep your child from needing to be punished. This can be done if mother begins the task when he is a baby and bears in mind that she should:—

1. Pay attention to him when he is good and not only when he is naughty.

2. Always do what she promises.

3. Speak and act the truth to her child.

4. Never threaten a baby with punishments she cannot carry out.

5. Never laugh at or praise him for something one day, and scold or punish him for the same thing to-morrow.

6. Remember that a healthy child cannot sit still or be quiet all the time. Every child needs plenty of out-door play—running, jumping, and climbing.

7. Keep him so busy with interesting things to do that he has no time to be naughty.

If you do not like what your child is doing, give him something else to do; don't scold him. Remember that none of his toys are half so interesting to him as the everyday things of the home—the pots and pans, the vegetables you are peeling for dinner, the coal in the scuttle. He wants to find out all about them, and it is very desirable he should do so. Let him have the things he cannot break. Put away the things he should not have so that he won't see them. Then he will not ask for them, and you need not say no. Above all, do not try to make your child "good" by frightening him. Don't say, "If you're not good the policeman will come and take you away." Don't frighten him with dreadful things that the doctor or the dentist will do to him if he is naughty. You will make him afraid of people whom he should come to regard as friends—the policeman, who is someone who will always lead him safely across the road, the doctor or dentist, whom he should trust as kindly people who always want to make him feel well and better. Worse still, you will teach him not to trust you.

Do not use punishments to make him afraid of the dark. When he was a baby he was not afraid of the dark, but you will make him so if you lock him away in the dark when he is naughty.

All human beings, children included, have to learn that we all pay, in some way or other, for the bad things we do, but punishments must not be so severe that children will tell lies to escape it. Whipping children, slapping them and putting them in dark cupboards are punishments that make them afraid and cause them to tell lies. The untruthful child is generally the pitiful little child who has been made afraid.

Plate 294.

THE BEAUTY OF A WELL-KEPT HEDGE.—In these terraced grounds, dry-stone walls are covered with a dense growth of Rhincospermum—the glory of the garden when in scented bloom.

Plate 295.
Sunset at Palm Island, North Queensland.

IN THE FARM KITCHEN.

CHRISTMAS PUDDINGS AND SAUCES.

Christmas Pudding.

Take ½ lb. suet, ½ lb. raisins, ½ lb. flour, ½ lb. currants, ¼ lb. peel, ¼ lb. sultanas, 1 oz. almonds, grated rind ½ lemon, 2 tablespoonfuls golden syrup, 2 eggs, ½ gill milk, ½ nutmeg (grated).

Prepare the fruits. Chop the suet. Mix the flour and suet together. Add the lemon rind, nutmeg, and prepared fruits. Cut the peel into small pieces, blanch the almonds and cut into pieces. Add these to the other ingredients and mix well. Whisk up the eggs, add the golden syrup, and whisk together. Put into a greased basin, cover with greased paper and floured pudding cloth. Put into a saucepan of boiling water and steam for eight hours. Turn on to a hot dish and serve.

Children's Christmas Pudding.

Take ¾ lb. grated beef suet, 1 lb. breadcrumbs, ¼ lb. fine flour, ¾ lb. raisins (stoned and chopped), ¼ lb. sultanas, grated rind and juice 2 oranges, ½ teaspoonful salt, 4 eggs, ½ lb. golden syrup, ½ pint milk.

Mix the dry ingredients first, warm the syrup, and mix with the beaten eggs and milk, add the strained orange juice; then work the whole into a stiff paste very thoroughly. Keep over for two days, mix again, then put into two well-greased moulds, tie down securely, and boil for four hours. Boil for another hour when going to use the puddings. A few blanched and split almonds should decorate the puddings when turned out of the moulds.

Plum Pudding.

Take 1 lb. currants, 1 lb. sultanas, 1 lb. sugar, ¾ lb. finely-chopped suet, ½ lb. flour, ½ lb. breadcrumbs, 1 lb. raw carrots (finely grated), 3 oz. candied peel, 1 oz. salt, 2 eggs, 1 grated nutmeg, ginger and cinnamon to taste.

Put all the dry ingredients into a large mixing basin. Cut up the candied peel very finely. Mix all well together and add the well-beaten eggs. Make the pudding two weeks before wanted, and steam it for six hours. Hang it up in the cloth in which it was boiled until it is required, when boil again for one or two hours. No milk or other moisture is required in mixing this pudding.

Rich Christmas Pudding.

Take 1 lb. finely-chopped suet, 1 lb. brown sugar, 1 lb. stoned raisins, 1 lb. currants, ¼ lb. candied peel (cut in thin slices), ½ lb. flour, 8 oz. breadcrumbs, 8 eggs, 3 oz. almonds (blanched and shredded), 1 saltspoonful grated nutmeg, 2 teaspoonfuls baking powder, grated rind of 1½ lemons, 1 teaspoonful salt, about ½ pint milk, 1 gill brandy.

Thoroughly mix together all the dry ingredients, then stir in the eggs, which have been well beaten; add gradually the milk and, lastly, the brandy. This quantity will make four good-sized puddings. Place in buttered moulds or basins, and steam for five hours. When needed for table, steam another two hours. Serve with any sauce which is preferred.

Christmas Pudding.

Take 3 oz. flour, 6 oz. suet, 3 oz. breadcrumbs, 6 oz. stoned raisins, 6 oz. currants, 4 oz. minced apple, 3 eggs, 5 oz. sugar, 2 oz. candied peel, ½ teaspoonful spice, 1 small wineglassful brandy, pinch of salt, ½ teaspoonful nutmeg.

Mix together the flour, breadcrumbs, chopped suet, raisins, currants, minced apples, sugar, peel (minced small), nutmeg, spice, a pinch of salt, the brandy and whole eggs. Mix and beat these ingredients well together, pour them into a well-buttered mould or basin, spread a buttered paper over, then tie a cloth firmly over the top. Boil for four hours, keeping the pudding well covered with boiling water, then turn it out, sift icing sugar thickly over the top, pour two or three tablespoonfuls of brandy round, and, just before serving, set it alight. This pudding may be served with wine or punch sauce, or with rum or brandy butter.

Individual Christmas Puddings.

Take 4 oz. suet, ½ lb. raisins, ¼ lb. currants, 2 oz. sultanas, 2 oz. candied peel, 1 oz. shelled walnuts, 4 oz. sugar, 3 oz. breadcrumbs, 1½ oz. flour, grating of nutmeg, ¼ flat teaspoonful ground cloves, 2 eggs, ½ gill rum.

Wash, pick over, and dry the fruits and stone the raisins. Shred the candied peel and chop up the walnuts. Sieve the flour with the spices, add the finely-chopped suet, and the breadcrumbs, then stir in the sugar, prepared fruits and nuts, and mix all together. Whisk the eggs and add them. Moisten the mixture with the rum and some milk as required. Beat it well and leave it to stand overnight, adding more moisture after that time, if necessary. Turn the mixture into six buttered moulds. Cover them securely with buttered papers and steam them for about an hour and a half or two hours. Unmould the puddings and serve them with half a shelled walnut on each.

hristmas Pudding.

Take ½ lb. breadcrumbs, ½ lb. raisins, 1 oz. citron peel, 1 grated carrot, ½ lb. brown sugar, ½ lb. muscatel raisins, ½ lb. shredded suet, 2 oz. lemon peel, 6 eggs, 2 nutmegs, ½ lb. currants, ¼ lb. orange peel, 3 oz. almonds, 6 oz. flour, 1½ gills ale, salt.

Mix the breadcrumbs, sugar, grated nutmeg, chopped raisins, cleaned currants, minced peels, and a pinch of salt together in a basin. Stir in the suet, then the blanched almonds. Add well-beaten eggs and remaining ingredients, without the ale. Beat for two or three minutes with a wooden spoon, then stir in the ale, cover, and leave for several days, stirring once daily. Pack into two buttered basins. Cover with buttered paper, then a floured cloth. Steam for seven or eight hours in a saucepan with boiling water coming half way up the sides. When required, cook for three hours, then turn out, sprinkle with vanilla sugar, decorate with a sprig of holly, and serve with brandy or rum custard.

Economical Christmas Pudding.

Take ½ lb. beef suet, ½ lb. flour, ½ lb. breadcrumbs, 6 oz. cleaned currants, 6 oz. stoned raisins, ½ lb. brown sugar, ½ lb. cooked carrot, ½ lb. cooked potato, 2 oz. candied peel (finely shredded), 1 teaspoonful salt, 2 tablespoonfuls brown treacle.

Rub the carrot and potato through a sieve. Mix together all the dry ingredients with the sieved carrot and potato, and this will require time, as it is not easy to mix them well without moisture. Last of all stir in the treacle, after warming it until it runs. Mix very thoroughly, and keep in the mixing basin several days, stirring the pudding every day. Then put into a large basin (well greased), cover with greased paper and thick dry paper over all, and steam for six hours. When re-heating, allow two hours for steaming through. Serve with brandy sauce or custard.

Almond Sauce.

Take ¼ lb. ground almonds, 2 oz. castor sugar, 1 whole egg and 3 yolks, ¼ pint cream, ¼ pint milk, 1 wineglassful brandy, ½ teaspoonful essence of bitter almonds.

Pound the almonds and sugar together in a basin, and add the egg and egg-yolks (well beaten), then milk and cream by degrees. Turn into a jug, place this in a saucepan of hot water, and stir till the mixture thickens, which will take quite a quarter of an hour. Remove from the heat and continue stirring at intervals till nearly cold, add brandy and essence, and heat again in the saucepan before serving.

Brandy Sauce.

Take 2 oz. butter, 2 oz. flour, ½ pint milk, pinch of salt, sugar, brandy.

Dissolve the butter, and work into it the flour until perfectly smooth; then dilute with the milk, slightly warmed. Add the salt, and bring to the boil, stirring all the time. Boil for two minutes, then add a little thick cream or another pat of cold butter. Pour a wineglass of brandy over six lumps of sugar; when dissolved, stir into sauce, which should not boil again.

Punch Sauce.

Take 2 oz. sugar, 1 oz. butter, 1 teaspoonful rice flour, ½ wineglassful rum, ½ wineglassful marsala, ½ wineglassful brandy, lemon, orange, 1 gill water.

Put the sugar on to boil with the water, the rind of half a small lemon (pared very thinly), and a rather smaller quantity of orange-peel. Let them simmer for fifteen minutes, then take out the peel. Mix the rice flour quite smoothly with a little cold water, and stir into the boiling syrup. Add the butter in small pieces, then the strained juice of half the orange, also a teaspoonful of the lemon juice. Boil for ten minutes, then add the rum, marsala, and brandy, but do not let the sauce boil after they are added.

Hard Sauce.

Take 4 level tablespoonfuls of butter, 2 level tablespoonfuls castor sugar, 4 teaspoonfuls brandy, pinch of grated nutmeg.

Beat the butter to a cream, beat in the sugar, then the brandy and nutmeg. Heap the mixture in a glass dish, and put it on ice or in a cold place until required.

SUMMER FRUIT DRINKS.

Nothing is more refreshing or pleasing in warm weather than a well-prepared fruit drink, while from a health point of view the habit of drinking fruit juices needs no stressing. Their wholesomeness may be particularly emphasised as beverages for children, who, left to their own devices, are quick to acquire the taste for them. Many so-called orange and lemon drinks contain no fresh fruit at all, but are made from chemicals and artificial colouring matter. Not only do they not have the food value that the real fruit possesses, but they may be definitely injurious to the child's health.

The only drinks of this kind that the child should be permitted to have should be made from the fresh fruit juice. Mothers who make real fruit juice drinks for their children will not be teased for artificial soda and other harmful drinks. Fruit juices not only satisfy thirst; the natural fruit acids they contain supply beneficial elements to the child's diet.

Pineapple Drink.—Wash the skin of pineapple. Place in a lined saucepan with the core and enough cold water to cover. Cook slowly three-quarters of an hour. Add 3 tablespoons or more sugar and the juice of 1 orange or lemon. Strain and allow to cool. Chill and serve.

Fruit Punch.—Take ½ cup lemon juice, 1 cup orange juice, grated rind ½ orange, 1 tablespoon grated lemond rind, 1 quart water, 3 or 4 cups of sugar. Cook water and sugar for 3 minutes, cool and mix with orange and lemond juice, rind, &c. To this add the following ingredients:—(1) 1 quart ginger ale, ½ cup preserved ginger cut up finely, (2) 1 cup grated pineapple, 1 pint soda water.

Fruit Cup.—Take 2 lemons, 1 quart boiling water, 2 oranges, 4 passion-fruit, 1 ripe pear (if available), 4 tablespoons sugar, few drops cochineal. Wash lemons, peel thinly into a large jug or bowl; squeeze juice and place it in jug with rind and sugar; pour the boiling water over this and cover till cold. Strain into glass jug, colour very pale pink, add slices or oranges, passion-fruit pulp, and cut pear or other fruit. Place in ice chest and serve very cold.

PASTEURISATION.

The object of pasteurisation is, firstly, to make milk and milk products safe, by destroying any disease germs that may be present; and, secondly, to improve the keeping quality of butter and cheese made from milk and cream so treated. Pasteurisation, however, has its limitations. It cannot perform miracles—such as improving the grade of cream from second to choice, or eliminating strong weed taints.

Most dairy farmers are aware of this, and know that the production of choice quality cream depends on the care and attention given on the farm, and that the pasteurisation process is beneficial in that a butter of choice quality can be manufactured to withstand long periods of cold storage.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF OCTOBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1937 AND 1936, FOR COMPARISON.

Divisions and stations.	Average Rainfall.		Total Rainfall.	
	Oct.	No. of years' records.	Oct., 1937.	Oct., 1936.
North Coast.	In.		In.	In.
Atherton	0·94	36	0·21	0·71
Cairns	2·13	55	0·03	0·16
Cardwell	2·05	65	0·28	0·18
Cooktown ..	1·03	61	0·75	0·15
Herberton ..	0·99	51	0·14	0·87
Ingham	1·90	45	0·02	0·05
Innisfail	3·27	56	0·55	0·19
Mossman Mill ..	3·02	24	0·18	0·11
Townsville ..	1·33	66	0·90	..
Central Coast.				
Ayr	0·92	50	0·22	..
Bowen	1·01	66	1·13	..
Charters Towers ..	0·72	55	0·67	0·03
Mackay	1·71	66	2·29	2·09
Prosperine ..	1·60	34	2·05	0·15
St. Lawrence ..	1·77	66	3·63	0·56
South Coast.				
Biggenden ..	2·40	38	4·52	0·61
Bundaberg ..	2·09	54	3·64	0·93
Brisbane	2·54	85	3·59	0·16
Caboolture ..	2·50	50	7·16	0·51
Childers	2·69	42	5·46	1·32
Crohamhurst ..	3·27	44	5·06	1·53
Esk	2·49	50	10·13	0·22
Gayndah	2·39	66	3·69	1·62
Gympie	2·70	67	4·95	0·92
Kilkivan	2·61	58	4·80	2·34
Maryborough ..	2·76	66	1·81	1·10
Nambour	3·07	41	8·76	1·05
Nanango	2·25	55	2·47	0·72
Rockhampton ..	1·77	66	2·27	0·86
Woodford	2·54	50	7·32	0·42

Divisions and stations.	Average Rainfall.		Total Rainfall.	
	Oct.	No. of years' records.	Oct., 1937.	Oct., 1936.
Central Highlands.	In.		In.	In.
Clermont	1·31	66	0·32	0·32
Gindie	1·37	38	..	..
Springsure ..	1·64	68	1·06	0·32
Darling Downs.				
Dalby	2·04	67	3·41	0·50
Emu Vale ..	2·17	41	2·89	0·53
Hermitage ..	1·86	31	..	0·34
Jimbour ..	1·87	49	1·50	0·75
Miles	2·02	52	2·11	0·28
Stanthorpe ..	2·53	64	1·72	0·73
Toowoomba ..	2·54	65	4·70	0·25
Warwick ..	2·29	72	3·81	0·47
Maranoa.				
Roma	1·76	63	0·96	0·36
State Farms, &c.				
Bungeworgorai ..	1·50	22	..	..
Gatton College ..	1·96	38	5·37	0·15
Kairi	1·02	21	..	..
Mackay Sugar Experiment Station	1·47	40	1·54	2·47

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—OCTOBER, 1937.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·95	84	73	97	21	60	22	75	2
Herberton	..	82	56	89	30	45	22	14	2
Rockhampton	30·01	89	65	97	25	57	20	227	3
Brisbane	30·02	82	63	99	24	58	14	359	9
Darling Downs.									
Dalby	30·01	83	56	97	25, 26	44	19, 3	341	7
Stanthorpe	..	76	49	91	26	37	3, 19	172	8
Toowoomba	..	77	54	92	24	44	3	470	8
Mid-Interior.									
Georgetown	29·94	96	65	102	25, 27	49	20	5	1
Longreach	29·94	96	63	107	26, 27	49	19	6	1
Mitchell	29·98	88	54	103	26	42	2	79	2
Western.									
Burketown	29·94	93	69	100	12	58	20	Nil	..
Boulia	29·90	96	63	107	26	50	17	Nil	..
Thargomindah	29·95	89	62	105	23	50	1, 17	Nil	..

ASTRONOMICAL DATA FOR QUEENSLAND.

Times Computed by A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

MOONRISE.

	December. 1937.		January. 1938.		Dec. 1937.	Jan. 1938.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	4·49	6·31	5 1	6·50	3·19	4·19
2	4·49	6·32	5·2	6·50	4·0	5·9
3	4·49	6·33	5·2	6·50	4·44	6·5
4	4·50	6·34	5·3	6·51	5·32	6·59
5	4·50	6·35	5·3	6·51	6·22	7·51
6	4·50	6·36	5·4	6·51	7·16	8·46
7	4·50	6·37	5·5	6·51	8·9	9·41
8	4·50	6·38	5·5	6·52	9·3	10·36
9	4·51	6·38	5·6	6·52	9·57	11·33
						p.m.
10	4·51	6·39	5 7	6·52	10·48	12·23
11	4·51	6·39	5·8	6·52	11·48	1·36
					p.m.	
12	4·51	6·40	5·9	6 51	12·44	2·43
13	4·52	6·40	5·9	6·51	1·45	3·48
14	4·52	6·41	5·10	6·51	2·49	4·51
15	4·52	6·41	5 11	6·51	3·55	5·51
16	4·52	6·42	5·12	6·50	5·4	6·41
17	4·53	6·42	5·13	6·50	6·8	7·27
18	4·53	6·43	5·13	6·50	7·9	8·9
19	4·53	6·43	5·14	6·50	8·7	8·49
20	4·54	6·44	5·15	6·50	8·55	9·29
21	4·54	6·44	5·16	6·49	9·40	10·5
22	4·55	6·45	5·17	6·49	10·18	10·47
23	4·55	6·45	5·18	6·49	10·56	11·18
24	4·56	6·46	5·19	6·49	11·39	11·58
25	4·56	6·46	5·19	6·48	..	..
					a.m.	a.m.
26	4·57	6·47	5·20	6·48	12·4	12·39
27	4 58	6 48	5·21	6·48	12·42	1·24
28	4·58	6·48	5·22	6·48	1·19	2·13
29	4·59	6·49	5·23	6·47	2·0	3·4
30	4·59	6 49	5·24	6·47	2·42	3·57
31	5·0	6·50	5·25	6·47	3·28	4·52

Phases of the Moon, Occultations, &c.

3rd	Dec.	●	New Moon	9 11 a.m.
11th	,,	☽	First Quarter	11 12 a.m.
19th	,,	○	Full Moon	4 52 a.m.
25th	,,	☾	Last Quarter	12 20 a.m.

Apogee, 4th December, at 3 a.m.
Perigee, 17th December, at midnight
Apogee, 31st December, at 4 a.m.

Mercury rises at 5.54 a.m., 1 hour 5 minutes after the Sun, and sets at 7.36 p.m., 1 hour 5 minutes after it, on the 1st; on the 15th it rises at 6.19 a.m., 1 hour 27 minutes after the Sun, and sets at 8.12 p.m., 1 hour 31 minutes after it.

Venus rises at 3.54 a.m., 55 minutes before the Sun, and sets at 5.18 p.m., 1 hour 13 minutes before it, on the 1st; on the 15th it rises at 4.2 a.m., 50 minutes before the Sun, and sets at 5.45 p.m., 56 minutes before it.

Mars rises at 9.23 a.m. and sets at 11.21 p.m. on the 1st; on the 15th it rises at 9.33 a.m. and sets at 10.44 p.m.

Jupiter rises at 8.14 a.m. and sets at 9.56 p.m. on the 1st; on the 15th it rises at 7.34 a.m. and sets at 9.13 p.m.

Saturn rises at 1.1 p.m. and sets at 1.21 a.m. on the 1st; on the 15th it rises at 12.8 p.m. and sets at 12.25 a.m.

On the 22nd, the day of our summer solstice, the Sun will be directly overhead at midday at all places 23½ deg. south of the celestial equator, and its vertical rays will make themselves felt more or less uncomfortably "We go in a circle by night, that we may not be consumed by fire" (a saying from the Latin, its origin unknown). Asked for an explanation, Mr. Eglinton answered that were there no circular movement around the earth's axis unmitigated heat would soon consume us. But in Spitzbergen at midsummer there is sunshine day and night—on account of the tilt of the earth's axis—and the "dazzling Sun" was seen there at midnight last June "over the silver birches and a range of low hills"; but a Finnish author said of such a night: "The whole nature is beaming, all is so soft, so clear, the most common objects are enveloped in an enchanting light. . . . "

In our hemisphere the finest of the northern constellations are now coming into view, rising a little earlier night by night. On Christmas Eve and later, when the Moon has waned, the Pleiades, the Hyades, Orion, and Canis Major, with Sirius, will form a brilliant curve in the north-east, while the great ship Argo, with Canopus, stretches full length from the Southern Cross to Canis Major, east of the zenith.

2nd	Jan.	●	New Moon	4 58 a.m.
10th	,,	☽	First Quarter	12 13 a.m.
16th	,,	○	Full Moon	3 53 p.m.
23rd	,,	☾	Last Quarter	6 9 p.m.

Perigee, 15th January, at 12 noon
Apogee, 27th January, at 4.0 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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